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ABSTRACT

This study examined the learning styles of postsecondary and secondary students in selected institutions throughout South Carolina. The sample included over 2,000 college and university students and over 6,000 high school students. The five-phased research program examined: (1) the learning styles of first-year college students; (2) the learning styles of majors in various disciplines and the association of learning styles with parents' educational level, family size, community, and college or university; (3) the relationship between retention and learning style; (4) the learning styles of high school students, including a comparison of secondary and postsecondary learning styles; and (5) learning styles in relation to gender and race. The study found that first-year college students preferred social and conceptual styles of learning to other styles, and that students with applied styles performed better in school and scored higher on standardized tests than did students with other styles. It also found that mathematics majors selected the applied category most often, whereas majors in humanities, social sciences, education, and business selected the conceptual category most frequently. Other significant results are discussed. Two appendixes provide copies of the student survey questionnaires and statistical tables. (Contains 91 references.) (MDM)

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An Investigation of the Learning Styles of Students at Selected Postsecondary and Secondary Institutions in South Carolina

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An Investigation of the Learning Styles of Students at Selected Postsecondary and Secondary Institutions in South Carolina

by:

Doris B. Matthews, Ph.D.
Professor
Department of Counselor Education and Psychological Foundations
South Carolina State University
Orangeburg, South Carolina 29117

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Calhoun Academy, Orangeburg-Wilkinson High School, Orangeburg Preparatory School, Wilson Academy, Edisto High School, North Augusta High School, Walterboro High School, Summerville High School, Furman High School, Clinton High School, Wagner-Salley High School, Seneca High School, Allendale-Fairfax High School, Blue Ridge High School, Andrew Jackson High School, Calhoun County High School, Barnwell High School, Estill High School, and Hillcrest High School. This research was dependent upon the collaboration of these colleges and universities as well as these high schools throughout the state.

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ABSTRACT

The purpose of the research was to examine learning styles, using the Canfield model, of postsecondary and secondary students in selected institutions throughout South Carolina. The sample included over 2,000 college and university students and 6,000 high school students. The research was a series of studies that occurred in five phases. The focus in Phase I was an investigation of learning styles of first-year students in colleges and universities. Phase II was an examination of the learning styles of majors in various disciplines in colleges and universities and of the association of learning style with parents' educational level, family size, community, and college or university. While Phase III focused on retention and learning style, Phase IV dealt with a thorough investigation of the learning styles of high school students, including a comparison of the secondary sample with the postsecondary sample. The final phase, Phase V, was an examination of learning style in relation to gender and race.

Overall, first-year students at colleges and universities preferred social and conceptual styles of learning to other styles. This finding varied with subgroups, however. Young women favored the conceptual styles more than did young men on the applied to conceptual continuum. On the other hand, young men preferred the social styles more than did young women on the social to independent continuum. Blacks chose conceptual and independent styles more frequently than did Whites.

With first-year students in colleges and universities, learning style had an association with grade point average and scores on the *Scholastic Aptitude Test*. Students with applied styles performed higher in school and scored higher on the standardized test than did students with other styles.

In Phase II, results showed learning style to have an association with major, parent's educational level, family size, and size of the college or university. Regarding the two continua, majors in mathematics selected the applied category most often,

whereas majors in humanities, social science, education, and business selected the conceptual category most frequently. Although some variance existed on the independent to social continuum, this variance was small. Father's education but not mother's education had an association with learning style; students with fathers without college or university degrees followed a pattern of learning style that was more conceptual than applied, whereas students with fathers with college or university degrees followed styles that were more applied than conceptual. With regard to family size, large families had more conceptual learners than did small and medium-sized families, and small and medium-sized families had more applied learners. Also, the small family produced more social learners when compared to the other two categories and the medium-sized and large families produced more independent learners than the small families. In this study, the large university had more students with applied styles while the moderate-sized universities and small colleges had more students with conceptual styles of learning.

When retention was under examination in Phase III, findings from the study revealed that learning style had no effect on White males who stayed in school at higher rates than did other subgroups. Learning style did have an association with the retention of White females and Blacks. The independent style had more holding power for White females. Black females with the social/applied style and Black males with independent and independent/applied styles stayed in school less frequently than students with other styles of learning.

The purpose of Phase IV was to examine the learning styles of high school students, including learner characteristics. Of interest was the association of learning styles with other variables: socioeconomic status, grade level, and achievement. The last objective of this phase was a comparison of the learning styles of the two levels, postsecondary and secondary. Findings showed learner characteristics to vary by gender and race. The predominant styles for high school students were social and

social combination typologies. While socioeconomic status and achievement did have an association with learning style, grade level had no association with learning style. The proportion of students in the various learning styles at the postsecondary level and secondary level differed in only two categories: conceptual and independent/conceptual. While larger proportions of students in the conceptual categories attend colleges or universities than attend in other styles, the high school had more students enrolled in the applied typologies than enrolled in conceptual typologies.

The focus of the last phase was learning style in relation to gender and race. Findings showed that differences in style existed between males and females as well as Blacks and Whites. Additionally, interaction effects of race and gender were in evidence.

Findings of these studies indicate the complexity of the learning style phenomenon among students. Results have implications for school administrators, counselors, and teachers in both settings: postsecondary and secondary.

PART I GENERAL

INTRODUCTION

CHAPTER 1

INTRODUCTION TO RESEARCH

Nature and Significance of the Problem

In view of current demographic realities, providing access to educational opportunities for students of various cultures and socioeconomic backgrounds requires institutions to rethink their curricula, testing practices, methods of instruction, counseling techniques, and delivery systems of other specific services. Access to education means the enhancement of career opportunities and thus, eventually, improved quality of life for individuals as well as families. Equal education not only incorporates widespread and specific opportunity, but includes, also, recognition and consideration of the stylistic strengths of students in the learning process. Because the stylistic strengths of students in South Carolina were generally unknown, the purpose of the current study was to describe the learning styles of postsecondary and secondary students in the state. Of particular interest were the learning styles of African Americans, or Blacks.

Learning style has a variety of definitions. Gregorc (1979) viewed learning style as distinctive behaviors that serve as indicators of the process by which people learn from and adapt to their environment. Hunt (1979) believed that learning style described students in terms of those educational conditions under which they were most likely to learn. Keefe (1982) organized learning style into such categories as modes, elements, and domains and believed that styles were cognitive, affective, and psychological behaviors that served as relatively stable indicators of the means by which learners perceived, interacted with, and responded to the learning environment. Canfield (1988) discussed conditions, content, modes, and expectations. Regardless of the definition, learning style preferences develop as a consequence of hereditary factors, life cycle experiences, and demands of the current environment (Kolb, 1981; 1984).

For this research, the Canfield model provided direction. For Canfield (1988), learning style refers to the affective component of the education experience that motivates a student to choose, attend, and perform well in a course or training exercise. The model is an instructional preference approach, based in turn on theoretical components of Maslow's hierarchy of needs and McClelland's notion of achievement motivation (Claxton & Murrell, 1987).

Whether formally recognized or not, learning style invites the attention of faculty and administrators in higher education and secondary schools. Individual faculty members' sense of students' learning processes, their awareness that others often approach solutions differently, and their successes and failures with different student groups, even when those groups are taught identically, reveal clearly that students learn differently. Excepting some relatively isolated situations and the work of particular individuals, however, it is fair to say that learning style has not significantly affected educational practices in higher education or in secondary schools. Yet, the need to improve educational practices is great, particularly in light of today's diversely prepared students and the current emphasis on effective teaching and the assessment of outcomes (Cross, 1986). Learning style is an extremely important element to consider in the move to improve curricula and instruction in secondary and postsecondary schools.

Information about learning style assists faculty to become more sensitive to the variegated experiences and motives students bring to the classroom. Informal interpretation of data serves, also, as a guide to design learning experiences with teaching styles which, depending on the overall purpose of the teacher, match or mismatch learning styles of students. Matching is particularly appropriate in working with poorly prepared students at both levels and with first-year college students at the higher education level (Dunn, 1990; Dunn, Beaudry, & Klavas, 1989). Studies (Andrews, 1981; Brunner & Hill, 1992; Canfield, 1988; Davidson,

Saveyne, & Orr, 1992) show that identifying the learning style of a student and then providing instruction consistent with that style contribute to more nearly effective learning. In other instances, some mismatching (Daloz, 1986; Hendricson, Berlocher, & Herbert, 1987; Perry, 1986) may be appropriate so that the experiences of students help them to learn in new ways and to affect patterns of thinking and aspects of the self not previously developed. Thus, knowledge of learning style can help faculty design experiences appropriate for students in terms of matching or mismatching and can enable instructors to do so systematically.

Besides being useful in teaching, information concerning learning style is markedly helpful in the area of student services. In counseling, for example, learning style may suggest appropriate approaches in counseling to use for particular students. Furthermore, when students have problems in courses, such information can guide in the design of intervention efforts of counselors. In the student service orientation, understanding of learning style can help students comprehend their own preferences and strengths in learning and can be a stimulus for developing new alternatives of learning. Also, when students have a choice, knowledge of learning style enables educationally impaired learners to select instructors whose teaching styles are compatible with the students' learning styles.

In a monograph on learning styles, Claxton and Murrell (1987) made a strong case for extending the current conventional range of research. According to these authors, three areas critically needed examination. The first and most pressing one was to learn more about the learning styles of minority students--a particularly important issue in the face of reported enrollment and graduation rates that indicate that higher education, and, to some degree, secondary education, are not serving Black students well ("Racial and ethnic enrollments," 1988). Changing demographics signify an even more diverse student body in the future, with increasing numbers of Blacks, Hispanics, and other ethnic groups. The second

need for research was to clarify the requisite congruence of teaching methods with the learning styles of students. The third and last need was for the examination of the connection and interaction among learning style, developmental stage, major or discipline perspective, and epistemology. These authors believe that a better understanding of the link among the three needs would provide a helpful framework for examining teaching methodologies, the role of learning in individual development, and the use of the disciplines to promote more complex and integrative thinking.

With the challenge of Claxton and Murrell (1987), the conceptualization and implementation of this research evolved in the hope that the data collected on learning styles of minority students, as well as those of other subgroups, would provide valuable information for decision-makers. One area of investigation was obviously lacking and in need of careful research in a socio-culturally diverse area that South Carolina uniquely provided: that of ethnic grouping. South Carolina has a particularly large and growing population of rural African Americans, without the influx of Asians and Hispanics that is rapidly making studies in larger states obsolete. Caskey (1981), Ewing and Yong (1992), Guild (1994), Hussein (1988), and Lam-Phoon (1988) have touched on the matter of ethnicity and learning styles, but the authoritative, particularized study of Blacks is this research.

While this investigation of learning style has general application, it is of special value to the rural people of South Carolina. Already established is the concept of individual differences, realities of the influences of genetics and nutrition, and acknowledgements of the conditions of roles of parenting and the larger social units (Guild, 1994). To some extent, research has already categorized styles, learning types, teaching styles, and predispositions and preferences (Brandt, 1990). Yet, no data show that significant numbers of poor rural Blacks have enough learning styles in common with the rest of the group to warrant special

restructuring of curricula, administration, or counseling services and techniques. This situation is acute because most small school districts currently need to focus their resources on essential intervention strategies while facing the realities of geographical distances.

When such students come to college, the findings from this research are of special value in dealing with learners, especially rural minority students, termed at-risk, that is, those who are so underprivileged and deprived, for various reasons, that they are seriously academically impaired and thus, psychologically unfit--lacking skills and motivation, and being too easily discouraged or demoralized--and prone to absenteeism from class, resistance to conferences and counseling, failure, and dropping out. In South Carolina, as one example, there is a severe problem with absolute illiteracy as well as functional illiteracy, not to mention alliteracy, that is, having the ability to read but not using the ability (South Carolina Census Report, 1992). With a statewide vocational and technological college system already on line, plus a pervasive educational broadcasting system, and emerging prominence of the state frontline universities and colleges, resources now or will soon exist for all students to enter the technological revolution and to advance in it.

Purpose and Duration of the Study

The main purpose of this research was to examine learning styles of students at selected postsecondary and secondary institutions in South Carolina. The research started in Summer, 1989, and concluded in April, 1995. It proceeded in five phases. Phase I dealt with the learning styles of first-year students at selected colleges and universities. Phase II investigated the learning styles of students with particular majors or disciplines in colleges and universities. Also, this phase included an examination of the association of learning style and social variables.

Phase III was a study of retention and learning styles. Phase IV made an extensive examination of the learning styles of secondary students in selected schools throughout the state. Phase V explored the association of gender and race as well as interaction effects of gender and race on the learning styles in both settings: postsecondary and secondary.

The investigation in each phase entailed a series of questions to be answered. The phases with their questions follow:

1. Phase I - An Investigation of the Learning Styles of First-Year Students in Colleges and Universities
    1. What are the learning style characteristics related to condition of learning, area of interest, and mode of learning?
    2. What types of learner typologies do first-year students in colleges and universities have?
    3. What is the association between learning style and grade point average?
    4. What effects does learner typology have on scores of students on the *Scholastic Aptitude Test*?
2. Phase II - An Investigation of the Learning Styles of Majors in Colleges and Universities as well as the Association of Social Variables and Learning Styles
    1. What are the learning styles of majors in colleges and universities?
    2. What effects do gender and race have on learning styles within majors?
    3. What is the association of learner typology and parents' educational level?
    4. What is the association of learner typology and family size?

5. What is the association of learner typology and community environment?
6. What is the association of learner typology and the size of college or university?

3. Phase III - An Investigation of Learning Styles and Retention
   1. What is the retention rate of students in each learner typology?
   2. What is the association of learning style and retention regarding gender?
   3. What is the association of learning style and retention regarding race?
   4. What is the association of learning style and retention when controlling for race and gender?
4. Phase IV - An Investigation of the Learning Styles of Secondary Students
   1. What are the learning style characteristics of secondary students concerning condition of learning, area of interest, and mode of learning?
   2. What are the learner typologies of secondary students?
   3. Do differences in learning style exist in relationship with socioeconomic status and grade level?
   4. Do learning styles and academic achievement have an association?
   5. How do secondary students compare with postsecondary students concerning style?
5. Phase V - An Investigation of Learning Styles in Relation to Gender and Race
   1. Do differences in learning style exist between males and females in postsecondary and secondary settings?
   2. Do differences in learning style exist between Black and White students at the two levels?

3. Are there interaction effects of race and gender regarding learning style for postsecondary students and secondary students?

Definition of Terms and Operationalization of Constructs

Scores from the Canfield (1988) *Learning Style Inventory* operationalized the term, learning style. The terms learning style and learner typology were in use interchangeably for the research. Additionally, postsecondary schools referred to four-year colleges and universities, and secondary schools referred to high schools containing Grades 9, 10, 11, and 12.

While achievement in the college and university sample referred to grade point average and mean score on the *Scholastic Aptitude Test*, achievement in the secondary sample was a self-rating score. Retention in the postsecondary sample was the number of students still in school three years after the initial sampling of first-year students; the holding power, or retention rate, of a college or university was the percentage of students retained over the three-year period.

With the college and university setting, socioeconomic variables constituted the mother's and father's educational level and the number of siblings in the family. On the secondary level, socioeconomic status referred to those students receiving a partial subsidy or free lunch or those students not receiving a partial subsidy or free lunch.

Other variables were community environment, grade level, and choice of major. Community environment was the type of area (rural, urban, or suburban) in which the student grew up. Grade level referred to Grade 9, Grade 10, Grade 11, or Grade 12. Majors in colleges or universities were those content areas that could be grouped to represent the disciplines of mathematics, science, business, humanities, social science, and education.

CHAPTER 2

RELATIVE SURVEY OF THE LITERATURE

Introduction

Scrutiny of the literature indicates that there is no lack of mention or awareness of learning style, nor an absence of questions as to the desirability of gaining an increased, competent awareness of such styles, their nature, their importance, and the effective manners by which they can be incorporated productively in the curriculum and other aspects of the school program. Researchers have examined the introduction of learning style in the educational system, as well as additionally salient questions about the nature of examination of subjective methodology in teaching (Boyatzis, & Kolb, 1991; Boylan, 1981; Mansfield & Murrell, 1991; Sharma, 1987). Chapter 2 gives an evaluated synthesis of the literature in relationship with the two areas under investigation in this study: postsecondary and secondary.

Three broad perspectives of learning styles are: cognitive, affective, and physiological. From the cognitive perspective, learning style includes the manner in which an individual processes, decodes, encodes, stores, and retrieves information (Gregorc, 1979; Kirby, 1979; Kolb, 1976; 1984). Characteristically, cognitive aspects of learning style relate to the ability of a learner either to focus or scan information, proceeding randomly or sequentially, concretely or abstractly. Each of these pairs of cognitive processes can be represented on a continuum, and, given time and the various instructional situations, a student may change his or her place on the continuum.

The affective aspect affords another opportunity to examine learning styles. Affectively, learning style encompasses emotional and personality characteristics related to motivation, locus of control, interests, persistence, responsibility, and sociability (Canfield, 1988; Hill & Nunnery, 1973; McCarthy, 1990; Messick,

1976). Depending upon the learner, praise and external reinforcement may have either a positive or negative effect on the learning process.

Lastly, it is possible to examine learning styles from the physiological aspects that relate to sensory perception and environmental characteristics (Barbe & Swassing, 1979; Griggs & Dunn, 1989). Perceptual learning style is the term used by James and Galbraith (1985) to describe this aspect of extracting information from the environment through the senses. Seven elements comprise this aspect of learning style: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. According to research by Galbraith and James, learners not only have a dominant preferred learning modality, but also use other selected subsidiary sensory modes to extract and process information.

The research from the literature reported below used one or more of the models described. Because different approaches are under discussion, the concept of learning style or typology has varying applicable meanings. Nevertheless, trends regarding differences appear.

Learning Styles of Postsecondary Students

Learning style appears to affect concretely the selection of majors by students in colleges and universities. A careful review of the literature indicated that choice of major seldom was as haphazard or ill-made as might superficially appear (Green & Parker, 1989; Myers & Myers, 1993). If one recognized the learning style of the learner, one could predict the major. Stone (1987), for example, concluded that the major one selects may affect learning style--or vice versa. Some majors, such as nursing, provided greater variations than others. Lundstrom and Martin (1986) observed a relationship between teaching style and learning style, so much so that the learning style probably influenced the preferences and performance of students. Smith (1980) indirectly raised the question of the major categorizing or

programming of students attending community colleges. Stice (1987), a professor of chemical engineering, found an opacity and obtuseness in the study of linear equations among the various learning style students who should have found such study in their own majors obvious and pleasurable; as a countermeasure, he proposed using Kolb's learning cycle, with implications for other courses. Claxton and Ralston (1978) reviewed Witkin's research, which found variations between field-dependent and field-independent subjects. In cross-cultural studies, it transpires that many field-dependents are not encouraged to be autonomous as children, while independents are; therefore, selection and success in college majors have a cultural association. Pressures of the peer group and of authority figures strongly influence dependents; thus, dependents often choose their majors under such influence of peer groups. Field-independent students use their analytical skills, for example, in mathematics, engineering, or science. Field-dependents prefer studies emphasizing interpersonal relations, such as social sciences, counseling, teaching, or sales.

Although the research regarding race is limited, and sometimes conflicting, several pioneering studies appear in the literature. Johnson (1990) studied Black and White college first-year students using Kolb's *Learning Style Inventory* and the *Myers-Briggs Type Indicator* and found significant differences between the two groups; Blacks had more sensing and thinking styles and used the assimilator mode for processing information, while their White counterparts had more intuitive and feeling styles and processed information to a greater extent using the diverger learning modality. Armstrong (1987), using a small sample of Black college students in evening school, found that, on Kolb's *Learning Style Inventory*, Blacks were predominantly divergers and assimilators, while Whites were predominantly convergers and accommodators. When using Kolb's instrument, also, Caskey (1981) found no significant differences among ethnic groups. Lam-Phoon (1988)

found, using Dunn's *Learning Style Inventory*, that Whites, when compared to Asians who had a high preference for auditory and visual learning, preferred warmth, responsibility, intake of food, learning in the morning, and mobility. Additionally, Hussein (1988) reported that, in the College of Engineering at the University of Wisconsin, American and International graduate students had a high preference on Canfield's *Learning Styles Inventory* for organized course work and aural information but only a moderate preference for peer affiliation, setting goals, and having close and personal relationships with instructors. Hussein noted, also, that the students had very strong expectancies for outstanding performance.

At least four studies in the literature investigated learning style and gender. When comparing females to males, Kraft (1976) found that females were more dependent upon teachers and peers, were less competitive, and participated more in activities. Claxton & Ralston (1978) found that women were more field-dependent than men were and that men generally choose types of careers involving analytical skills, as is consistent with subjects who are field-independent. Cross-cultural influences and factors exist, as, for instance, students from abroad (Hussein, 1988), bringing their learning skills with them into the new environment and expecting an adaptation and matching. Participatory reasons may also be of some significance. Because international students may come from male-dominant societies, their academic implementation of learning styles may be correspondingly affected. The implications for study of American subcultures, whether based on gender or other characteristics, are therefore rather obvious (Gadzella, Hughes, Lumpkins, Pappert, Robertson, Stafford, & Walling, 1987).

The research on matching learning styles with teaching styles is inconclusive. Lundstrom and Martin (1986), using Gregorc's *Styles Delineator*, found no significant interaction effects occurring between instructional method and learning style mode for student achievement or student attitude. Also, Sanley (1988) found

no significant relationship between learning styles and problem solving success when using Whimbey's *Analytical Skills Inventory*. On the other hand, Clark-Thayer (1987) reported a low, but significant, correlation between learning style and college achievement. Additionally, Terrell (1976) found, while utilizing Hill's *Cognitive Style Mapping Instrument*, that matching learning style of the student and the teaching style of the teacher decreased the anxiety of students and insured higher grades. As a result of inconclusive findings, much research remains to be done in the area of matching learning styles and teaching styles; in some situations, a teacher must master a diverse menu of alternate teaching styles to nurture particularly disadvantaged or immature learners (Ault, 1986; Barger & Hoover, 1984; Jaeger, 1987). Also, teachers need to examine objectively and specifically their own styles and from where they are derived or developed (Toppins & Dunlap, 1984).

Learning Styles of Secondary Students

Secondary students demonstrate differences in learning style as well as do college and university students. Guild and Garger (1985) stated that students of any age differ in their manners of learning. For instance, Price (1980) found that students in secondary school experience a greater need to learn and study alone than during any other interval. Pettigrew (1988), using the Canfield *Learning Styles Inventory*, found strong preferences for peer and instructor affiliation, competition, inanimate, qualitative, iconics, and direct experience and strong nonpreferences for organization, detail, people, and lecturing. Pettigrew also found gender differences. Females showed strong preferences for peer and instructor affiliation, people, and qualitative materials while males indicated stronger preferences for characteristics such as goal setting, learning alone, numerics, and inanimate aspects of learning characteristics.

Titus, Bergandi, and Shryock (1990) found, using the Kolb inventory, that secondary students were more nearly concrete than abstract on the concrete to abstract continuum. The differences between a secondary sample and an adult sample were significant; the adult population measured to a greater degree abstract than did adolescents. This finding suggested maturation in the learning style phenomenon.

Shargey (1989) found gender and ethnic differences in students enrolled in health occupations in high school regarding learning style characteristics. Also, Ewing and Yong (1992) found differences in style of gifted students with varying ethnic backgrounds: African American students preferred the kinesthetic modality of learning, American born Chinese preferred the visual modality, and Mexican American students preferred visual and kinesthetic modalities to auditory modality. The Myers-Briggs research (Lawrence, 1982) found that young women and young men differed in styles with young women more likely to be on the feeling end of the thinking to feeling continuum, while young men tended to cluster on the thinking end. Likewise, Stewart (1981) conducted a study with gifted students and found gender differences existed in preferred styles of learning. On the other hand, Barbe and Milone (1984), when studying modalities, found no differences between males and females on kinesthetics, a trait often called a male characteristic.

Other findings concerning ethnic differences were available in the literature. For example, Guild (1994) reported that Blacks value oral experiences, physical activity, and loyalty in interpersonal relationships. Whites, on the other hand, value independence, analytic thinking, objectivity, and accuracy. It must be noted that these statements are generalizations about total groups and may lead to naive inferences about subgroups or individuals within the group.

Learning style has a relationship to student achievement in school though researchers (Guild & Garger, 1985) believe learning styles are neutral in relation to intelligence. Evidence suggests that students with particular learning style traits (field-dependent, sensing, extraversion) are underachievers in school, irrespective of their cultural group (Guild, 1994). Renniger and Snyder (1983) found standardized test scores related to learning styles but not grades. Research with gifted students (Perrin, 1984), special education students (Brunner & Majewski, 1990), high risk youngsters (Gadwa & Griggs, 1985), and average students (DeBello, 1985; Perrin, 1984) has provided consistent documentation that student achievement increased significantly in classrooms where individual learning styles were identified and accommodated.

The effect of family variables on learning style is an almost unexplored area. Guild (1994) reported that researchers agree that learning style is a result of nature and nurture. For instance, Myers and Myers (1993) believe that type is inborn but the successful development of type can be greatly helped or hindered by environment. Kagan (1966) reported that his success with training impulsive students to become more reflective was minimal; when students changed, the error rate increased. Other researchers (Phelps, Raferty, Mulkey, and McNamara, 1990) studied low, middle, and high socioeconomic status students regarding learning style as measured by the Dunn and Dunn model and found no significant differences on 12 characteristics: motivation, persistence, responsibility, structure, learning alone/peer oriented, authority figure, auditory, visual, tactile, kinesthetic, parent motivated, and teacher motivated. However, when compared with the other groups, students from low socioeconomic status families had low scores in motivation and responsibility and high scores on the need for structure and the need to learn by auditory and visual modes. It is evidence that this area requires additional research.

The survey discloses that some crucial omissions occur in the base currently provided by the literature: this inspection indicates possibilities for some essential contributions which indeed this study provides. Hitherto, researchers have paid scant attention to the specific new typologies added to the Canfield model; this study reports learner typologies for both postsecondary and secondary populations. Additionally, there are noticeable omissions in the literature specifically dealing with the learning styles of Black students in relationship with White students, as well as interaction effects of gender by race. Lastly, an almost completely unexplored area is that of the relationship of family variables and learning style; this study addresses this matter in considerable detail.

PART II STUDIES OF PHASE I, PHASE II, PHASE III, PHASE IV, AND PHASE V OF THE RESEARCH

CHAPTER 3

AN INVESTIGATION OF THE LEARNING STYLES OF FIRST-YEAR STUDENTS IN COLLEGES AND UNIVERSITIES

Introduction

The first study in a series of studies to investigate learning styles dealt with first-year postsecondary students. The study attempted to answer questions concerning the targeted population. The questions were:

1. What are learning style characteristics related to condition of learning, area of interest, and mode of learning?
2. What types of learner typologies do first-year postsecondary students have?
3. Does learning style affect grade point average?
4. What effect does learner typology have on scores of students on the *Scholastic Aptitude Test*?

Methodology

Sample

The sample included 971 respondents (475 males and 496 females) from a population of approximately 8,000 first-year students at four-year colleges and universities in South Carolina during the 1989-90 academic school year. The sample, representing approximately 12 percent of the population, consisted of students from intact classes in English, including remedial classes, or biology selected by randomization.

In the study were students from two small private institutions, enrollment from 700 to 800; two medium-sized state universities, enrollment from 4,000 to 5,000; and one large state university, enrollment approximately 15,000. Racial composition was 540 whites, 416 blacks, and 15 students of other races. With the

educational levels of mothers and fathers being indicators of socioeconomic status, the larger portion of the sample was from the middle class, ranging from low to upper, because 60 percent of both fathers and mothers had either college degrees or some training in higher education. Most of the participants came from small families: only 39 percent had more than three brothers and sisters. Furthermore, the majority of the students (71%) were from rural areas or small towns with less than 20,000 persons.

Because the number of students of other races was small, the researcher excluded them from some analyses. In addition, first semester grade point averages were not available for students who entered school the second semester. Also, because some students took the *American College Test*, *Scholastic Aptitude Test* scores were unavailable for a few students. Thus, the reported numbers may not agree with the total (971) in some tables under consideration.

Instrumentation

Learning Styles Inventory. To determine learning style, this research used the *Learning Styles Inventory* developed by Albert A. Canfield and Wynelle Knight (1983). The instrument is a self-report questionnaire that allows students to describe the features of their educational experiences they most prefer. On the answer sheet, students ranked the answer choices for each question using a four-point scale, with 1 indicating the most-liked choice and 4 being the least-liked choice. The instrument has 21 scales, including eight preferred conditions for learning (peer, organization, goal setting, competition, instructor, detail, independence, and authority); four preferred areas of interest (numeric, qualitative, inanimate, and people); four preferred modes of learning (listening, reading, iconic, and direct experience); and five expectations for course grades (A, B, C, D, and total expectations). The analyses for this research eliminated student responses to questions involving grade expectations.

Using t-scores from the various components of the 21 scales, one can compute a learner typology, or style of learning (Canfield, 1988; Gruber & Carriuolo, 1991). The learning style results from the point of intersection of two continua: social to independent (Y axis) and applied to conceptual (X axis). The vertical column (Total score = peer + instructor - goal setting - independence) falls on the social to independent continuum, and the horizontal column (Total score = organization + qualitative + reading - direct experience - inanimate - iconic) falls on the applied to conceptual continuum. The "X" axis has scores from negative 15 to positive 15 and the "Y" axis has scores from negative 10 to positive 10.

The instrument has nine distinctive categories: social, independent, applied, conceptual, social/applied, social/conceptual, independent/applied, independent/conceptual, and neutral preference. The person who has a social learning style prefers extensive opportunities to interact with peers and instructors and enjoys instruction involving small groups. Independent learners like to work alone toward individual goals and select instructional styles that emphasize analyses of case studies or self-selected and self-paced programs. Students with applied styles opt to work in activities directly related to perceived real-world experiences and enjoy instructional techniques that involve practica, site visits, and teamwork in laboratories. The conceptual learner prefers to work with highly organized, language-oriented materials and likes lectures and reading activities. Social/applied persons choose to have opportunities to interact with other students and instructors in activities closely approximating perceived real-world experiences and enjoy instructional techniques such as role playing, group problem solving, and supervised practica. Social/conceptual people select opportunities to interact with students and instructors using highly organized, language-oriented materials and choose teaching strategies that balance lecture and discussion. Independent/applied

students prefer to work alone toward individual goals in activities closely approximating perceived real-world experiences and enjoy techniques of instruction such as laboratory work and unsupervised technical practica. Independent/conceptual persons choose to work alone toward individual goals with highly organized, language-oriented materials, and to read to gain knowledge. Persons with neutral preference have no clear style and may find it difficult to become entirely involved in the instructional process. Table 3-1 shows a full description of each typology.

The *Learning Styles Inventory* has validity and rather high reliability. Values on individual item analysis produced coefficients ranging from .87 to .97. Split-half reliability results indicated a range proportionally higher than the one for the individual items, with the split-half coefficients ranging from .96 to .99. The validity of the instrument lies in its ability to discriminate meaningful group differences in learning style preferences. Research showed that students selecting certain majors or careers appeared to have learning styles expected of the groups (Canfield, 1988).

The norming sample showed notable differences in the preferences of men and women across all of the scales measuring learner characteristics, particularly in the area of interest scales. The test developer provides t-scores for calculating the learning style profile that reflect these differences.

Other Measures. The researcher constructed the *Student Demographic Questionnaire* to describe characteristics of the sample. Responses to the form provided pertinent information, such as gender, age, race, mother's and father's

Table 3-1

Descriptive Summary of Learning Types

Style	Description
Social	Prefers extensive opportunities to interact with peers and instructors; has no strong preference for either applied or conceptual approaches; instruction involving small groups and teamwork creates the closest match.
Independent	Prefers to work alone toward individual goals; has no strong preference for either applied or conceptual approaches; instructional techniques such as analysis of case studies or self-selected and self-paced programs create the closest match.
Applied	Prefers to work in activities directly related to real-world experience; has no strong preference for either social or independent approaches; instruction involving practica, site visits, and team labs creates the closest match.
Conceptual	Prefers to work with highly organized language-oriented materials; has no preference for either social or independent approaches; instruction involving lectures and reading creates the closest match..
Social/Applied	Prefers to have opportunities to interact with students and instructors in activities closely approximating real-world experience; instruction involving role playing, group problem solving, and supervised practica creates the closest match.
Social/Conceptual	Prefers to have opportunities to interact with students and instructors using highly organized language-oriented materials; instruction involving a balance of lecture and discussion creates the closest match.
Independent/Applied	Prefers to work alone toward individual goals in activities closely approximating real-world experience; instruction involving individual labs or unsupervised technical practica provides the closest match.
Independent/Conceptual	Prefers to work alone toward individual goals with highly organized language-oriented materials; instruction allowing for independent reading, literature searches, and reviews creates the closest match.
Neutral Preference	Has no clear areas of strong preference; may find adequate match in any other type, but may also at times find it difficult to become entirely involved.

educational level, number of siblings in the family, and hometown size. A copy of the questionnaire is in Appendix A-1.

The study used also grade point averages and scores on the *Scholastic Aptitude Test*. Grades and test scores were on file in the registrar's office in the various colleges or universities.

Procedures

In the fall of 1989, the researcher sought participation from a representative sample of colleges and universities in South Carolina, giving attention to representational factors of ethnicity and range of entrance requirements. Administrators in institutions that agreed to participate selected the Department of English or the Department of Biology for the administration of the *Learning Styles Inventory* and *Student Demographic Questionnaire*. The reason for the use of these two disciplines was that English and biology are mandatory for all first-year students. These disciplines provided a cross-section of males and females comprising the first-year student body.

Faculty, or a person from the research staff, administered the instruments during the months of January, February, and March. Students answered the inventory and data questionnaire according to instructions, giving their social security numbers but no names. The social security numbers enabled the researcher to request grade point averages for the first semester and *Scholastic Aptitude Test* scores that were in the computer database at the Registrar's Office at each college or university.

The research staff prepared the inventories and questionnaires for entry in the computer. The Statistical and Data Management Laboratory at the Office of 1890 Research at South Carolina State University entered the data and provided support for data analyses.

Analysis of Data

Four statistical procedures comprised data analysis for this study: analysis of variance, chi-square, percentages, and Least Significant Difference test (LSD). The analysis of variance procedure provided the information for determining significant differences between gender and race as well as identifying interaction effects of gender by race. After computation of learner typologies, the chi-square procedure determined significant differences in proportion of students among the nine learning categories. Likewise, percentages showed the proportion of students (totals, Blacks vs. Whites, and males vs. females) in figures with learner typology categories.

For the analysis of the association of learner typology with grade point average and *Scholastic Aptitude Test* scores, the study used the analysis of variance. The candidate for *post hoc* tests was the Least Significant Difference test (LSD).

Findings

Learner Characteristics

The first question to be answered by the research related to learner characteristics. Table 3-2 shows the means and standard deviations for the total sample by rank for condition of learning, area of interest, and mode of learning. Considering condition of learning, the group preferred a personal relationship with the instructor (mean = 11.79), clearly organized course work (mean = 12.04), and specific assignments and requirements (mean = 12.94). Independence (mean = 18.91) and competition (mean = 17.04) were the least liked conditions of learning. In area of interest, working with other people (mean = 13.46) and working with concrete objects (mean = 15.11), such as building, repairing, designing, and operating, had top priority as motivational techniques. In mode of

Table 3-2

Means and Standard Deviations for Learning Style Characteristics: Condition of Learning, Area of Interest, and Mode of Learning

Characteristic[1]	Rank	Mean	Standard Deviation
Condition of Learning			
Instructor	1	11.79	3.27
Organization	2	12.04	3.07
Detail	3	12.94	3.13
Peer	4	15.00	3.07
Goal Setting	5	15.92	3.12
Authority	6	16.36	3.26
Competition	7	17.04	2.76
Independence	8	18.91	3.37
Area of Interest			
People	1	13.46	3.93
Inanimate	2	15.11	4.28
Numeric	3	15.28	4.56
Qualitative	4	16.13	4.37
Mode of Learning			
Direct Experience	1	13.28	4.01
Iconic	2	13.75	4.07
Listening	3	14.82	3.96
Reading	4	18.15	4.25

Note: Scores are ranks. Lower scores signify higher preference.

[1] Number of students equals 790.

learning, students preferred direct experience (mean = 13.28) and iconics (mean = 13.75), or visuals, over listening (mean = 14.85) and reading (mean = 18.15).

The means and standard deviations by gender and race appear in Appendix B (see Appendices B-1, B-2, and B-3). Tables 3-3 and 3-4 show the results of analysis of variance on condition of learning, area of interest, and mode of learning. There was a significant difference between males and females on peer, organization, detail, independence, numeric, qualitative, inanimate, people, and listening. Males relied more on peers, working independently, use of numbers, and manipulation of concrete objects, than did females. Females liked organization, detail, language activities, other people, and listening more than males did. Significant race effects were on instructor, authority, people, listening, reading, iconics, and direct experience. Blacks preferred authority and getting information from reading more than did Whites, while Whites felt more of a need to know and relate to the instructor, work with other people, and learn by listening, iconics, and direct experience than did Blacks. Interactions occurred on the learner characteristics of peer, goal setting, and people. Black males rely more on peers for learning than did other groups, White males and Black females prefer setting goals more than did their counterparts, and White females are more people-oriented than were other subgroups.

Student Learning Styles

The second purpose of the study was to determine the learning styles of first-year students. The researcher computed learner typologies, or styles, by converting the raw scores from the learner characteristics to t-scores using the norms for males and for females provided by Canfield (1988).

Table 3-3

Results of Analysis of Variance on Condition of Learning

Condition	Source	Sum of Squares	df	F-Value
Peer				
	Gender	111.929	1	12.056***
	Race	3.189	1	0.344
	Gender x Race	68.525	1	7.381**
Organization				
	Gender	280.493	1	30.746***
	Race	19.463	1	2.133
	Gender x Race	3.869	1	0.424
Goal Setting				
	Gender	13.039	1	1.372
	Race	5.678	1	0.440
	Gender x Race	37.543	1	3.950*
Competition				
	Gender	6.372	1	0.836
	Race	14.324	1	1.880
	Gender x Race	0.024	1	0.003
Instructor				
	Gender	28.948	1	2.762
	Race	235.970	1	22.512***
	Gender x Race	11.483	1	1.095
Detail				
	Gender	58.164	1	6.009**
	Race	4.731	1	0.489
	Gender x Race	8.120	1	0.839
Independence				
	Gender	48.958	1	4.329*
	Race	22.659	1	2.004
	Gender x Race	2.462	1	0.218
Authority				
	Gender	21.932	1	2.132
	Race	326.269	1	31.721***
	Gender x Race	0.942	1	0.092

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3-4

Results of Analysis of Variance on Area of Interest and Mode of Learning

Characteristic	Source	Sum of Squares	df	F-Value
Area of Interest				
Numeric				
	Gender	455.685	1	22.406***
	Race	48.969	1	2.408
	Gender x Race	1.992	1	0.098
Qualitative				
	Gender	1362.819	1	76.998***
	Race	45.679	1	2.581
	Gender x Race	0.136	1	0.008
Inanimate				
	Gender	2848.172	1	185.679***
	Race	9.802	1	0.639
	Gender x Race	53.081	1	3.461
People				
	Gender	1409.870	1	101.527***
	Race	119.994	1	8.641**
	Gender x Race	78.272	1	5.637*
Mode of Learning				
Listening				
	Gender	80.140	1	5.159*
	Race	129.486	1	8.336**
	Gender x Race	0.673	1	0.043
Reading				
	Gender	8.685	1	0.528
	Race	1560.990	1	94.901***
	Gender x Race	3.326	1	0.202
Iconic				
	Gender	0.011	1	0.001
	Race	169.322	1	10.434***
	Gender x Race	49.510	1	3.051
Direct Experience				
	Gender	36.120	1	2.279
	Race	231.269	1	14.596***
	Gender x Race	35.353	1	2.231

* $p < .05$; ** $p < .01$; *** $p < .001$

The number and percentage of students in each learner style appear in Figure 3-1. The chi square procedure showed a significant difference ($x^2 = 41.63$, $p < .05$) among the proportions of students in the various categories of learning styles. The larger proportions of students had social styles: social (14.2%) and social/conceptual (13.5%). The next larger proportions of students fell in the categories of neutral preference (13.0%), conceptual (11.9%), and social/applied (11.8%). The least preferred styles were independent/applied (7.2%), independent (8.3%), applied (9.5%), and independent/conceptual (10.5%). With the exception of the neutral preference category, the proportions of students in the social/conceptual and social categories were high enough to make them significantly different from proportions in all other categories.

Figures 3-2 and 3-3 show the distribution of respondents by learning style for gender and race, respectively. The two gender groups (chi-square = 41.99, $p < .05$) and race groups (chi-square = 34.50, $p < .05$) differed significantly in their preference for learning style. Males overwhelmingly preferred social styles of learning [social (16.6%), social/applied (16.2%), and social/conceptual (13.9%)] to independent styles: independent/conceptual (8.4%), independent (6.7%), and independent/applied (5.3%). Approximately 14 percent of the males had a neutral style, indicating no strong preference for any of the styles. On the applied to conceptual continuum, slightly more males had a conceptual style (32.2%) than an applied style (30.8%). On the other hand, females were more evenly distributed on the social (32.7%) to independent (31.6%) continuum. Females were, however, overwhelmingly more conceptual (39.8%) than applied (26.1%). Whites were more applied than were Blacks (35.1% vs. 19.9%, respectively), and Blacks were more conceptual than were Whites (43.0% vs. 30.0%, respectively). On the other continuum, Whites were more social than were Blacks (41.7% vs. 33.8%,

Social/Applied 115 (11.8%)	**Social** 138 (14.2%)	**Social/Conceptual** 131 (13.5%)
Applied 92 (9.5%)	**Neutral Preference** 126 (13.0%)	**Conceptual** 116 (11.9%)
Independent/Applied 70 (7.2%)	**Independent** 81 (8.3%)	**Independent/Conceptual** 102 (10.5%)

Figure 3-1. Distribution of Respondents by Learner Typology

Social/Applied Males = 77 (16.2%) Females = 38 (7.7%)	**Social** Males = 79 (16.6%) Females = 58 (11.8%)	**Social/Conceptual** Males = 66 (13.9%) Females = 65 (13.2%)
Applied Males = 44 (9.3%) Females = 46 (9.3%)	**Neutral Preference** Males = 65 (13.7%) Females = 61 (12.4%)	**Conceptual** Males = 47 (9.9%) Females = 69 (14.0%)
Independent/Applied Males = 25 (5.3%) Females = 45 (9.1%)	**Independent** Males = 32 (6.7%) Females = 49 (9.9%)	**Independent/Conceptual** Males = 40 (8.4%) Females = 62 (12.6%)

Figure 3-2. Distribution of Males and Females by Learner Typology

Social/Applied Whites = 79 (14.6%) Blacks = 35 (8.4%)	**Social** Whites = 83 (15.4%) Blacks = 54 (13.0%)	**Social/Conceptual** Whites = 63 (11.7%) Blacks = 64 (15.4%)
Applied Whites = 66 (12.2%) Blacks = 24 (5.8%)	**Neutral Preference** Whites = 65 (12.0%) Blacks = 60 (14.4%)	**Conceptual** Whites = 55 (10.2%) Blacks = 60 (14.4%)
Independent/Applied Whites = 45 (8.3%) Blacks = 24 (5.8%)	**Independent** Whites = 40 (7.4%) Blacks = 39 (9.4%)	**Independent/Conceptual** Whites = 44 (8.1%) Blacks = 56 (13.5%)

Figure 3-3. Distribution of Whites and Blacks by Learner Typology

respectively), and Blacks were more independent than were Whites (28.6% vs. 23.8%, respectively).

Grade Point Average

The third question asked about the effects of the various learning styles on grade point average. Table 3-5 shows the number of students in each category and the rank of the category according to grade point average. Those students with a social/applied style (mean = 2.60) made slightly higher grades than students with the independent/applied (mean = 2.58) and social (mean = 2.57) styles. The students with no strong preference for any style, neutral preference (mean = 2.22), made the lowest grades. Other categories were applied (mean = 2.53), social/conceptual (mean = 2.45), conceptual (mean = 2.44), and independent/conceptual (mean = 2.44), and independent (mean = 2.33).

Table 3-5

Means and Standard Deviations of Grade Point Average by Learner Typology

Learner Typology	Number	Rank[1]	Mean	Standard Deviation
Social/Applied	115	1	2.60	.82
Independent/Applied	70	2	2.58	.70
Social	138	3	2.57	.82
Applied	92	4	2.53	.92
Social/Conceptual	131	5	2.45	.80
Conceptual	116	6.5	2.44	.99
Independent/Conceptual	102	6.5	2.44	.88
Independent	81	8	2.33	.91
Neutral Preference	126	9	2.22	.76

Note: This analysis is on 765 persons because some students in the sample entered college second semester; therefore, no grade point averages were available for those students.

[1] Rank is based on the mean grade point average.

Results of the analysis of variance reflected an effect of learning style, gender, and race (see Table 3-6) on grade point average. The table in Appendix B-4 gives the means and standard deviations for grade point averages of students. For learning styles, Modified LSD procedures determined that the means in the categories of conceptual, social/conceptual, applied, social, social/applied, and independent/applied differed significantly from the means in neutral preference. Also, the independent style mean differed significantly from the means in social and social/applied categories.

For race, Whites had higher grades than Blacks did at institutions of higher education. For gender, females had higher grades than males did in all categories.

Table 3-6

Results of Analysis of Variance on Grade Point Average

Source of Variation	Sum of Squares	df	F-Value
Main Effects			
Learning Styles	12.571	10	2.344*
Gender	11.124	1	16.595***
Race	9.357	1	13.958***
Two-Way Interactions			
Learning Style by Gender	7.652	8	1.427
Learning Style by Race	1.706	8	0.318
Gender by Race	0.716	1	1.068

* $p < .05$; ** $p < .01$; *** $p < .001$

Males with an independent style had lower grade point averages than males with the neutral preference. In comparison with females who had definite style preferences, female students with no strong preferences for style (neutral) performed poorly.

Scholastic Aptitude Test

Total Battery. The last question to be answered related to the effects of learning style on standardized test scores. Table 3-7 shows the rank of the means on the total score of the *Scholastic Aptitude Test*. The means indicate that students in the independent/applied, applied, and social/applied styles ranked first, second, and third, and show that students with these typologies scored higher than students with other styles scored. The low scorers were in the social/conceptual category. Appendix B-5 shows the means and standard deviations for the learning styles by gender and by race. As can be seen in Table 3-8, there was an effect of learning style and race on scores for the *Scholastic Aptitude Test*. Post hoc tests (Modified LSD procedure) show students in the social, social/applied, applied, and

Table 3-7

Means and Standard Deviations of *Scholastic Aptitude Test* Scores by Learning Styles

Learner Typology	Number	Rank[1]	Mean	Standard Deviation
Independent/Applied	70	1	898.00	204.45
Applied	92	2	895.76	216.73
Social/Applied	115	3	867.30	230.41
Social	138	4	858.84	236.83
Independent/Conceptual	102	5	779.90	291.43
Neutral Preference	126	6	779.84	255.40
Conceptual	116	7	767.07	311.58
Independent	81	8	766.91	282.16
Social/Conceptual	131	9	746.11	310.78

Note: Because SAT scores were not available for some students, only 750 students were in this analysis.

[1] Rank is based on the mean SAT scores.

Table 3-8

Results of Analysis of Variance of *Scholastic Aptitude Test* Scores

Source of Variation	Sum of Squares	df	F-Value
Main Effects			
Learning Styles	970789	8	2.534*
Gender	50689	1	1.059
Race	2147074	1	448.382***
Two-Way Interactions			
Learning Style by Gender	191494	8	0.500
Learning Style by Race	272931	8	0.712
Gender by Race	1386	1	0.029

* $p < .05$; ** $p < .01$; *** $p < .001$

independent/applied typologies to have significantly higher scores than students in all the other learning style categories. For race, Whites outscored Blacks significantly in every category.

Mathematics Subtest. Table 3-9 shows the means and standard deviations for the total sample on the mathematics subtest of the *Scholastic Aptitude Test*. The analysis of variance reflected an effect of learning style, gender, and race on scores of the mathematics subtest (see Table 3-10).

Because there were nine categories of learning styles, further analyses were necessary. The modified LSD procedure indicated significant differences in means to be among the high categories of social (mean = 460.36), social/applied (mean = 477.30), independent (mean = 486.00), and applied (mean = 496.00) and the low categories: neutral preference (mean = 414.28), independent (mean = 410.12), independent/conceptual (mean = 410.00), conceptual (mean = 402.07), and social/conceptual (mean = 387.48).

The means in Appendix B-6 indicate that Whites made higher scores on the mathematics subtest than did Black students. Excepting the social typology, males scored higher than females in all other typologies.

Verbal Subtest. Means and standard deviations for the scores for the various styles of learning are in Table 3-11. Table 3-12 displays the results of the analysis of variance, showing no effect regarding learning style on scores of the verbal subtest of the *Scholastic Aptitude Test*. The table shows a race effect, however, but no gender effect. Whites outscored Blacks on the verbal subtest (see Appendix B-7).

Discussion

The present research contributes to the study of learner characteristics and learner typologies resulting from those characteristics. Very little research is in the

Table 3-9

Means and Standard Deviations of Mathematics Subtest Scores of the *Scholastic Aptitude Test* by Learning Styles

Learner Typology	Number	Rank[1]	Mean	Standard Deviation
Applied	92	1	496.00	134.11
Independent/Applied	70	2	486.00	111.78
Social/Applied	115	3	477.30	129.97
Social	138	4	460.36	133.87
Neutral Preference	126	5	414.28	141.54
Independent	81	6	410.12	151.68
Independent/Conceptual	102	7	410.00	152.43
Conceptual	116	8	402.07	163.58
Social/Conceptual	131	9	387.48	164.09

[1] Rank is based on the mean scores.

Table 3-10

Results of Analysis of Variance on Mathematics Subtest Scores of the *Scholastic Aptitude Test*

Source of Variation	Sum of Squares	df	F-Value
Main Effects			
Learning Styles	581670	8	4.930***
Gender	58145	1	3.942*
Race	5808740	1	393.838***
Two-Way Interactions			
Learning Style by Gender	83407	8	0.707
Learning Style by Race	61557	8	0.522
Gender by Race	10742	1	0.728

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 3-11

Means and Standard Deviations of Verbal Subtest Scores of the *Scholastic Aptitude Test* by Learning Styles

Learner Typology	Number	Rank[1]	Mean	Standard Deviation
Independent/Applied	70	1	413.43	103.42
Applied	92	2	398.59	96.20
Social	138	3	398.48	116.00
Social/Applied	115	4	390.09	110.35
Independent/Conceptual	102	5	368.92	145.85
Neutral Preference	126	6	365.55	123.58
Conceptual	116	7	365.17	156.09
Social/Conceptual	131	8	358.63	153.98
Independent	81	9	356.79	139.05

[1] Rank is based on the mean scores.

Table 3-12

Results of Analysis of Variance on Verbal Subtest Scores of the *Scholastic Aptitude Test*

Source of Variation	Sum of Squares	df	F-Value
Main Effects			
Learning Styles	101008	8	1.074
Gender	171	1	0.015
Race	4963100	1	4963100.231***
Two-Way Interactions			
Learning Style by Gender	40500	8	0.431
Learning Style by Race	111186	8	1.182
Gender by Race	4740	1	0.403

* $p < .05$; ** $p < .01$; *** $p < .001$

literature using an affective design like Canfield's model. Trends in the data should help college administrators and faculty see the opportunity to focus on the needs of the individual.

First-year students in the sample failed to meet traditional expectations for the condition of learning at the college or university level, that is, working independently and competitively. Instead, they indicated a need for dependency on the instructor, preferring a close relationship with the teacher. Also, students wanted organized course work and specific assignments and requirements. Examination of the area of interest showed that the group chose working with people and inanimate objects over numerics and qualitative objects or situations. Mode of learning preferences were direct experiences and iconics, or visuals.

As expected, gender differences occurred in learner characteristics. Because there are separate norms for males and females for the *Learning Styles Inventory*, the author of the scale found differences in the norming group, also. Males in this research preferred working with peers, working independently, using numbers, and handling inanimate objects more than females did. In support of existing literature (Belenky, Clinchy, Goldberger, & Tarule, 1986; Hanson, Silver, & Strong, 1984; Lawrence, 1982; Straub, 1987), females indicated that they liked organization, detail, language activities, other people, and the listening mode more than males did. Also, race differences occurred: Blacks preferred having demonstrable teacher authority and getting information from reading, and Whites placed emphasis on interpersonal relationships with the instructor, working with other people, and learning by the modes of listening, iconics, and direct experience.

With learner characteristics converted to nine learner typologies, specific trends emerged. On the social to independent continuum, almost twice as many students had social styles as had independent styles. Using postsecondary students, other researchers (Frusher & Aldridge, 1990) had similar findings: 66 percent of

their sample preferred social or cooperative learning and only 34 percent chose independent or competitive activities. In this study, more students (37.1%) had conceptual typologies than had applied typologies (28.2%) on the conceptual to applied continuum. When examining males separately, the researcher found that the trend continued with greater numbers in the social typologies. Females, however, were more evenly distributed on the social (26.1%) to independent (31.6%) continuum. Although males were almost evenly divided between conceptual styles (32.2%) and applied styles (30.8%), females were uneven, with approximately 40 percent being conceptual and 26 percent being applied.

The finding that approximately 14 percent of the males and approximately 12 percent of the females had a neutral preference was alarming. Students without strong preferences may find instruction using a variety of materials and approaches satisfying; but, on the other hand, such students may reflect some degree of general noninvolvement, finding it difficult to participate in a given educational activity (Canfield, 1988). Females, in particular, demonstrated lower performance with the neutral style; females' grade point averages were the lowest on the neutral preference style when compared with the eight other styles.

At first, the large number of males (47.6%) with social learning styles perplexed the researcher. According to Tannen (1990), however, males depend on groups more than women do and males have different reasons for group participation. Males find motivation in group status, whereas females use groups for connecting. Also, the Southern culture provides avenues for males at an early age to become team players, with special emphasis on games such as baseball, football, and basketball. On the other hand, females usually have one or two best friends and often view persons of the same gender as competitors. Because the Canfield model is affective, much of the behavior related to learning may very well be due to unique or unusual early personal and regional experiences at home, at

school, and in the community. As males approach the upper levels in higher education, they may learn to work more independently and to compete individually with their peers.

Examination of grade point average in the various learning style categories revealed that students in the social/applied, independent/applied, and social styles had higher grades. Males in the social/applied category made higher grades than did students in other categories, whereas females in the social style earned higher grade point averages than did women in each of the other categories. When considering race and achievement, the best style was independent/applied for Whites and social/applied for Blacks. Other researchers (Clifford, 1973; Hoffman & Betkouski, 1981; Letteri, 1980; Miller, Alway, & McKinley, 1987; Silver, Hanson, & Strong, 1979) agree that persons with some learning styles have a greater potential for success in school, especially with the school's emphasis on symbols, abstractions, and multiple-choice testing.

Learning style had a significant relationship to *Scholastic Aptitude Test* scores of students. Students with social/conceptual, conceptual, independent, and neutral preference had low scores when compared to students in other categories. Learners with social, social/applied, independent, and applied styles were high scorers when compared to counterparts. Although there were no gender differences, race differences existed with Whites outperforming Blacks.

Interestingly, separate examination of subtests of the *Scholastic Aptitude Test* revealed a significant learning style effect for only mathematics, indicating that some styles were better than others for doing well on tests of mathematics. Students with applied styles of learning outscored counterparts on the mathematics subtest. Although males and females performed equally well on verbal in the various typologies, Whites outperformed Blacks on this subtest in every category.

The findings from this descriptive study of first-year students have application for the student (self-awareness), the instructor (delivery of instruction), the counselor (advisement of students), and the administrator (curriculum organization and student personnel services). A full description of implications appears in Chapter 8.

CHAPTER 4

AN INVESTIGATION OF THE LEARNING STYLES OF MAJORS AND THE ASSOCIATION OF SOCIAL VARIABLES RELATED TO STYLE IN COLLEGES AND UNIVERSITIES

Introduction

Phase II had two purposes. One was to examine the learning styles of students in various major areas, and the other was to investigate the association of social variables and learning style.

Learning style researchers (Canfield, 1988; Kolb, 1984; Hoffman & Waters, 1982) use differences in the styles of majors as one method for establishing validity of instruments. When majors behave in the expected direction, the validity of an inventory is high. Although Canfield (1988) established validity for the 21 scales, he had not established it for the nine learner typologies. Therefore, this investigation serves as a partial validation for the nine learner categories as well as a description of the students found in particular disciplines.

The association of learner typology and specific social variables was of interest. Variables for study included parents' educational level, a variable used often as a measure of socioeconomic status. Additional variables were (1) family size, (2) community environment (rural, suburban, or urban), and (3) college or university.

Specifically, the questions to be answered were:

1. What are the learning styles of majors in colleges and universities?
2. What effects do race and gender have on learning styles within majors?
3. What is the association of learner typology and parents' educational level?
4. What is the association of learner typology and family size?

5. What is the association of learner typology and community environment?
6. What is the association of learner typology and college or university?

Methodology

Sample

The sample consisted of 2,429 students in selected four-year colleges and universities in South Carolina. The total sample included 1,109 males and 1,320 females. Of that number, there were 1,134 Blacks, 1,264 Whites, and 31 students of other race. Students came from three state supported institutions and two private schools, representing a population of approximately 26,000 young men and women. A description of the schools follows.

The location of School A, a large university, was in the rural area known as the upper part of the state. The sample from School A included 421 males and 394 females, for a total of 815 students. Of the total, 738 students were White, 63 students were Black, and 14 students were in the category of other race. This university offers majors in many areas but is the leader in the state in granting engineering, forestry, and agricultural degrees.

School B, a moderate-sized, predominantly white university, was in the lower part, a mixed urban-rural area, of the state. The university with a total sample of 385 students had 168 males and 217 females; there were, also, 321 Whites, 60 Blacks, and 4 students of other race. The institution, located in a medium-sized city, offers majors predominantly in business, education, and liberal arts.

School C was a moderate-sized, predominantly Black university, located in the midland region of the state, an area deemed geographically rural. The university is similar to School B in its course offering, that is, it has mainly business, education, and liberal arts majors. The university, with a total of 792

young men and women in the sample, had 310 males, 482 females, 39 Whites, 748 Blacks, and 5 students of other race.

School D was a small, private, predominantly White college located in the upstate, still in a rural area. The college's curriculum is mainly religious education and liberal arts. The school had 132 males, 81 females, 163 Whites, 45 Blacks, and 5 students of other race in the sample. The total was 213 students.

School E was also a small, private institution, but was predominantly Black. This school was in the midlands of the state, heavily rural but within commuting distance of moderately-sized cities well under one million. Its curriculum mirrored that of School D. In the sample, School E had 78 males, 146 females, 3 Whites, 218 Blacks, and 3 students of other race. The total sample included 224 students.

While there were a few younger (683) and older (165) students in the total sample, the majority (1,510) were in the age category of 19 through 24. Although 41 percent of the students had fathers with a high school education or less, 59 percent had some college or had degrees in higher education. The same pattern was true for the educational level of mothers. Forty-two percent of the mothers had high school or less, but 58 percent had degrees in higher education, or, at least, some college education. Most of the males and females in the sample came from homes in the rural areas (41.9%) or small towns of the state (26.5%), that is, with a population of less than 20,000.

The sample included students from majors in education, mathematics, science, business, humanities, and social science. Table 4-1 shows a detailed distribution of students in each major. Students in the major areas were: 387 (education), 529 (mathematics), 456 (science), 505 (business), 182 (humanities), and 323 (social science). The research had cluster sampling, with classes randomly selected from the courses being offered on the schedule for spring semesters.

Table 4-1

Distribution of Students by Major

	Number						
	Male			Females			
Major	Black	White	Other	Black	White	Other	Total
Education	55	29	1	145	152	4	387
Mathematics	102	242	14	66	100	5	529
Science	35	153	4	93	169	2	456
Business	131	95	5	206	67	1	505
Humanities	38	42	2	52	46	2	182
Social Sciences	78	55	3	113	68	5	323

Instrumentation

This study used the two main instruments that the previous study used. Majors answered the *Learning Styles Inventory* by Albert A. Canfield and Wynelle Knight (1983) and the *Student Demographic Questionnaire* developed by the principal investigator. A review of the inventory and questionnaire is in the discussion for the previous study.

Procedures

During the spring semester of two succeeding years, students at the private and public institutions answered the two instruments. Each institution had a facilitator who assumed the responsibility for coordinating with faculty and administering the instruments to select classes. When the facilitators completed the administration of the instruments, they returned the data to the researcher for scoring and data analysis.

Because of small enrollment numbers in specific majors, combining similar majors into larger academic discipline categories seemed a practical procedure. Six categories (mathematics, science, business, humanities, education, and social science) represented the majors in this research. The category of mathematics included all students with majors in general mathematics, engineering, computer science, and architecture. The category of science included students in programs seeking degrees in biology, chemistry, physics, nursing, pharmacy, forestry, and agricultural science. Students with majors in economics, agribusiness, management, banking and finance, marketing, accounting, office occupations, and home economics were in the category of business. The category of humanities included art, music, English, foreign language, history, and drama. Such teaching options as early childhood, elementary, secondary, special, and physical education were in the category of education. Students with majors in psychology, sociology, social welfare, political science, and criminal justice were in the category of social science.

The *Student Demographic Questionnaire* provided the data to make associations with social variables. For instance, the questionnaire asked about the mother's and father's educational level, the number of siblings in the family, and the type of community from which the student came.

Analysis of Data

Selected statistical procedures comprised the analyses for this research. Percentages showed the proportion of students in the various learner typologies. Additionally, the chi-square test determined if there were significant differences in proportion of students among categories of the learning styles for major, gender, and race. Also, chi-square was the statistical procedure for determining the association of learning style and the variables of parents' educational level, family size, community environment, and specific colleges or universities. The numbers

may vary in the analyses because a few students failed to designate a major and because of the exclusion of other race students in the examination of race difference.

To examine gender, race, and major differences on the two continua, students were grouped in three categories. The continuum for the conceptual to applied ("X" axis) represented persons in (1) conceptual, with a score greater than 15; (2) neutral, with a score from negative 15 to positive 15; and (3) applied, with a score of less than negative 15. On the "Y" axis, social to independent continuum, (1) social represented persons with scores greater than 10, (2) neutral represented persons with scores between negative 10 and positive 10, and (3) independent represented students with scores of less than negative 10.

Combination of categories in relationship to parents' educational level was necessary. For the analysis, the three categories from the *Student Demographic Questionnaire* of (1) sixth grade education and below, (2) some high school, and (3) high school formed one collective category, without a college or university degree. The categories of (1) associate degree, (2) bachelor's degree, and (3) graduate degree formed another collective category, with a college or university degree. Thus, the combination of categories made two revised categories for analysis.

For the examination of family size, the category from the *Student Demographic Questionnaire* of students with no brothers or sisters became the category of a small family, with one or two siblings categorized as a medium-sized family, and three or more siblings categorized as a large family. Therefore, family size had only three categories for the analysis.

Findings

Learning Styles of Majors

Question 1 asked about the learning styles of majors in colleges and universities. Table 4-2 shows the number and percentage of students in the various learner typologies by major. The chi-square statistical test shows significant differences in the proportion of students in the majors (chi-square = 190.09, $p < .05$). These differences in style can be examined by plotting scores on the two continua that intersect to form learner typologies. Table 4-3 shows the number and percentage of students in the applied, neutral, and conceptual categories by major. The chi-square test showed that the differences were significant (chi-square = 161.42, $p < .05$). Table 4-4 shows the number and percentage of students in the three categories on the independent to social continuum by major. Styles of students were not significantly different for the three categories: independent, neutral, and social. From the information, one can see that majors in mathematics selected the applied category most often, whereas majors in humanities, social sciences, education, and business selected the conceptual category most frequently. Although some variance existed on the independent to social continuum, the variance was small.

Gender and Race Regarding Learning Style and Major

With consideration of the total sample, males and females differed in the categories on the two continua. On the applied to conceptual continuum, the differences were significant (chi-square = 19.44, $p < .05$). Both male and female learners preferred the conceptual category to other categories, but female preference was greater than male preference for this category. Likewise, male preference was greater than female preference for the applied category. On the independent to social continuum, more males preferred the independent category than females, and more females preferred the social category than males. The chi-

Table 4-2

Number and Percentage of Students in Learner Typologies by Major

	Mathematics		Science		Business		Humanities		Soc. Sci.		Education	
Typology	N[1]	P[2]	N	P	N	P	N	P	N	P	N	P
Social/ Conceptual	49	13.4	56	15.3	93	25.4	41	11.2	63	17.2	64	17.5
Social	72	22.1	63	19.3	77	23.6	17	5.2	45	13.8	52	16.0
Social/ Applied	88	37.1	54	22.8	42	17.7	10	4.2	14	5.9	29	12.2
Conceptual	27	8.1	65	19.6	88	26.5	42	12.7	57	17.2	53	16.0
Neutral Preference	63	24.1	44	16.9	50	19.2	16	6.1	36	13.8	52	19.9
Applied	65	33.0	46	23.4	31	15.7	4	2.0	16	8.1	35	17.8
Independe Conceptual	51	17.6	55	19.0	55	19.0	33	11.4	46	15.9	49	17.0
Independent	60	26.3	49	21.5	43	18.9	14	6.1	30	13.2	32	14.0
Independent/ Applied	54	37.0	24	16.4	26	17.8	5	3.4	16	11.0	21	14.4

[1]Number of students.
[2]Percentage of students within each typology across majors.

Table 4-3

Number and Percentage of Students in Three Categories on the Applied to Conceptual Continuum by Major

	Mathematics		Science		Business		Humanities		Soc. Sci.		Education	
Typology	N[1]	P[2]	N	P	N	P	N	P	N	P	N	P
Applied	207	39.2	124	27.2	99	19.6	19	10.4	46	14.2	85	22.0
Neutral	195	36.9	156	34.2	170	33.7	47	25.8	111	34.4	136	35.1
Conceptual	126	23.9	176	38.6	236	46.7	116	63.7	166	51.4	166	42.9

[1] Denotes the number of students.
[2] Denotes the percentage of students.

Table 4-4

Number and Percentage of Students in Three Categories on the Social to Independent Continuum by Major

	Mathematics		Science		Business		Humanities		Soc. Sci.		Education	
Typology	N[1]	P[2]	N	P	N	P	N	P	N	P	N	P
Social	209	39.6	173	37.9	212	42.0	68	37.4	122	37.8	145	37.5
Neutral	155	29.4	155	34.0	169	33.5	62	34.1	109	33.7	140	36.2
Independent	164	31.1	128	28.1	124	24.6	52	28.6	92	28.5	102	26.4

[1] Denotes the number of students.
[2] Denotes the percentage of students.

square test showed these differences to be significant on the three categories of the independent to social continuum (chi-square = 55.44, $p < .05$). Within the majors, gender differences existed only in business on the applied to conceptual continuum, with males more applied than females and females more conceptual than males. On the independent to social continuum, gender differences existed for the majors of education, mathematics, business, and social science, with males more independent than females and females more social than males.

Race was also a significant factor on the total sample. The differences between White and Black students (chi-square = 130.64) in the three categories of the applied to conceptual continuum were significant at the .05 level of confidence. Upon examination of the two extremes, Blacks were more conceptual than Whites, whereas Whites were more applied than Blacks. No race differences existed on the independent to social continuum. In the majors, race differences occurred in

mathematics, science, business, and social science on the applied to conceptual continuum, with Whites more applied than Blacks and Blacks more conceptual than Whites. Only the major of business differed for race on the independent to social continuum, with more Blacks being in the social category than Whites, and more Whites being in the independent category than Blacks.

Association of Parents' Educational Level with Learning Style

The third question for the investigation asked about the association of parents' educational level and learning style. Table 4-5 shows the number and percentage of students in the categories, without a college or university degree and with a college or university degree, for each of the learner typologies. Chi-square results for mother's educational level (chi-square = 8.922; $p > .05$) indicated no relationship with students' learner typologies. The father's educational level, however, indicated a significant relationship (chi-square = 43.294; $p < .05$). Students with fathers without college or university degrees followed a pattern of learning style that was more conceptual than applied, whereas students with fathers with college or university degrees followed styles that were more applied than conceptual. On the social to independent continuum, both groups favored social styles, but the students who had fathers with college or university degrees had more independent styles than the other group.

Association of Family Size with Learning Style

The fourth area of investigation was the relationship of learner typology and family size. Table 4-6 gives the number and percentage of students in each learner typology for the three categories (small, medium, and large). The association of learner typology and family size is significant (chi-square = 33.978; $p < .05$). Large families have more conceptual learners than small or medium-sized families, and small and medium-sized families have more applied learners. The small family category had more social learners than the other two categories. Medium-

Table 4-5

Number and Percentage of Students in Each Learner Typology by Parents' Educational Level

	Mother				Father			
	Without College		With College		Without College		With College	
Typology	N[1]	P[2]	N	P	N	P	N	P
Social/Conceptual	234	15.5	131	14.4	216	16.1	135	13.5
Social	212	14.0	126	13.8	181	13.5	147	14.7
Social/Applied	146	9.7	95	10.4	126	9.4	112	11.2
Conceptual	215	14.2	117	12.9	201	14.9	116	11.6
Neutral Preference	177	11.7	94	10.3	173	12.9	86	8.6
Applied	128	8.5	71	7.8	90	6.7	105	10.5
Independent/Conceptual	177	11.7	119	13.1	174	12.9	112	11.2
Independent	142	9.4	88	9.7	121	9.0	104	10.4
Independent/Applied	79	5.2	69	7.6	63	4.7	82	8.2

[1] Number of Students.
[2] Percentage of Students.

Table 4-6

Number and Percentage of Students in Each Learner Typology by Family Size

	Small Family		Medium Family		Large Family	
Typology	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
Social/Conceptual	37	18.8	172	13.4	164	17.2
Social	32	16.2	170	13.3	136	14.2
Social/Applied	20	10.2	142	11.1	81	8.5
Conceptual	24	12.2	165	12.9	146	15.3
Neutral Preference	18	9.1	138	10.8	112	11.7
Applied	21	10.7	107	8.4	72	7.5
Independent/Conceptual	17	8.6	157	12.3	124	13.0
Independent	14	7.1	134	10.5	82	8.6
Independent/Applied	14	7.1	96	7.5	39	4.1

sized and large families produced more independent learners than did the small family.

Association of Community Environment with Learner Typology

The fifth question asked about the association of learner typology and the community environment in which students socialized and interacted during their youth. The community environment referred to rural (below 10,000 population), suburban (population from 10,000 -20,000), or urban (population over 20,000). The number and percentage of students in each learner typology by community size are in Table 4-7. The chi-square procedure showed no significant differences among the three groups regarding learner typology (chi-square = 7.973; $p > .05$). Therefore, the size of the community had no effect on learning style.

Table 4-7

Number and Percentage of Students in Each Learner Typology by Community Size

	Rural		Suburban		Urban	
Typology	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
Social/Conceptual	147	14.3	101	15.6	122	16.6
Social	151	14.7	88	13.6	96	13.1
Social/Applied	107	10.4	63	9.7	70	9.5
Conceptual	132	12.9	89	13.7	108	14.7
Neutral Preference	119	11.6	72	11.1	75	10.2
Applied	80	7.8	61	9.4	58	7.9
Independent/Conceptual	127	12.4	71	10.9	95	12.9
Independent	99	9.7	65	10.0	64	8.7
Independent/Applied	63	6.1	39	6.0	47	6.4

Association of Size of College or University with Learner Typology

The last question in this subsection addressed the association of learner typology and size of college or university. School A representation the large universities in the study, School B represents the predominantly White university that is of moderate size, School C represents the moderate-sized university that is predominantly Black, School D is the small private college that is predominantly White, and School E is the small private college that is predominantly Black. The chi-square procedure showed a significant association of learner typology and postsecondary structure (chi-square = 191.137; $p < .05$). Table 4-8 gives the number and percentage of students in each learner typology by college or

Table 4-8

Number and Percentage of Students in Each Learner Typology by College or University

	School A		School B		School C		School D		School E	
Learner Typology	**N[1]**	**P[2]**	**N**	**P**	**N**	**P**	**N**	**P**	**N**	**P**
Social/Conceptual	87	10.6	58	14.9	127	16.0	37	17.2	65	28.8
Social	123	15.0	52	13.4	106	13.3	32	14.9	26	11.5
Social/Applied	110	13.4	44	11.3	55	6.9	22	10.2	12	5.3
Conceptual	69	8.4	67	17.2	140	17.6	18	8.4	43	19.0
Neutral Preference	87	10.6	38	9.8	100	12.6	32	14.9	14	6.2
Applied	105	12.8	33	8.5	37	4.6	19	8.8	8	3.5
Independent/Conceptual	78	9.5	42	10.8	127	16.0	22	10.2	31	13.7
Independent	86	10.5	37	9.5	69	8.7	21	9.8	19	8.4
Independent/Applied	77	9.4	18	4.6	35	4.4	12	5.6	8	3.5

[1] Number of Students.
[2] Percentage of Students.

university. After examining the table, one can see that the moderate-sized universities and small colleges had more social/conceptual and conceptual learners than the large university had. The schools varied little on social and independent categories. In the applied and combination applied areas, however, the large university exceeds all other institutions in learners in these styles. Predominantly Black institutions have a high concentration of students with conceptual and conceptual combination styles. The variance on the social to independent continuum among colleges and universities is minimal.

Discussion

Majors in disparate areas have different proportions of students in the learning style categories, a finding that suggests that students select majors that match their styles of learning by way of their perceived potential for success. For instance, students in humanities placed at the far right of the applied to conceptual continuum, revealing students in art, music, drama, dance, and English to be conceptual learners. Mathematics majors placed at the far left of the applied to conceptual continuum, indicating that the learning styles of majors in computer science, engineering, and mathematics were predominantly applied, the direct opposite of majors in humanities. Although 25 to 31 percent of the students in each major selected the independent category, students in all majors preferred the social category on the social to independent continuum.

Males and females differed in their learning styles in the total sample. Excepting business, however, no gender differences among styles appeared in the majors on the applied to conceptual continuum. However, gender differences existed in four areas (education, mathematics, business, and social sciences) for the independent to social continuum. In previous research, Chusmir (1983; 1990) found that, despite gender, students in a discipline had similar styles of learning, and the results on this research were not totally supportive of Chusmir's findings. Certain majors had learning style differences between males and females.

When examining the sample as a whole, race differences occurred only on the applied to conceptual continuum, not the independent to social continuum. When one examined race within majors, the areas of mathematics, science, business, and social science showed a significant difference on the applied to conceptual continuum and business on the independent to social continuum. Blacks were more conceptual and social than their White counterparts. The findings indicate the necessity for variation in the instructional delivery system in major areas for

Whites and Blacks, particularly when new information is being presented. To retain minority students in majors such as mathematics and science, counselors at the institutions may have to work with faculty on their teaching strategies and curriculum organization, as well as with individual students on self-awareness and the use of alternate learning styles.

It is interesting to note that all learning styles are represented in a major category. Although one style of learning might match the requirements of a discipline more than other styles, students may find success in that discipline even if their style varies from the predominant style, because they have learned how to be flexible. The findings from this research showed that learning styles were similar for majors in education, business, and social science, making majors in these areas able to change disciplines with ease, if they desire. When styles of students are a mismatch from instructors, counselors, and other personnel, the institution should make some adjustments (Kolodny, 1991). In the College of Nursing, one study found a 77 percent dropout rate when the majority of students had a sensing-extroversion style and instructors had an intuition-introversion style (Kalsbeek, 1986). Since selected students fail to adjust to the teaching styles of instructors or to the demands of administrators, they drop out of school. Students who drop out represent a loss in human potential that institutions could instead develop by being sensitive to the stylistic needs of students.

The findings from this study provide partial validation for the nine learner typologies in the new edition of Canfield's (1988) *Learning Style Inventory Manual*. Majors in selected disciplines tended to have the trait or style that one would expect for that area.

In the examination of associations, the findings showed a significant association of learner typology and specific social variables. For instance, the father's, but not the mother's, educational level had an effect on learner typology.

Family size showed a significant relationship with learning style. There was, also, a significant college or university effect with style. Community environment had no effect on learner typology.

The significant effect for father's educational level and for family size with learning style may have a relationship with the socioeconomic level of the family. Also, the significant effect for college or university on learning style may be because of the major areas offered at a particular institution and/or the predominant race attending the school.

In Phase I of this research, findings showed that Blacks followed the conceptual typologies more than Whites did. On the social to independent continuum, both groups followed social styles more often than independent styles. The same trend followed in Phase II. Other researchers (Guild, 1994; Claxton & Murrell, 1987) found differences related to culture and learning style. Because members of subgroups are in all the learner typologies, it is a serious error to conclude that all members of the group have the same style traits as the group taken as a whole. Therefore, institutions that are predominantly Black have the same challenge as predominantly White institutions; the challenge is to provide a variety of methods of instruction, curricula, and student personnel services so that all responsive students find success.

Findings showed majors in the disciplines of mathematics and humanities to be significantly different from majors in the disciplines of business, science, social science, and education. The large university in this study has a concentration of curricular areas that are mathematics-related such as engineering, architecture, computer science, and regular mathematics, lending one to believe that these curricula draw students who prefer the applied styles of learning.

The findings from the research have useful applications. Students may use the findings in making career choices, counselors may use the findings in adapting

counseling techniques to students, instructors may use the findings to adjust instruction and curriculum to the needs of students, and administrators may use the findings to hire faculty members who display selectionable teaching styles. The association of style with social variables validates the nature and nurture aspects of the learning style phenomenon.

CHAPTER 5

AN INVESTIGATION OF LEARNING STYLE AND RETENTION

Introduction

The fourth investigation in the series of studies examined learner typology and retention. Very little research exists on the specific phenomena of retention and learning style, and the utilization of the Canfield model in particular in determining the phenomena. This study, therefore, provides answers to four questions related to retention and learning style. The questions are:

1. What is the retention rate of students in each learner typology?
2. What is the association of learning style and retention regarding gender?
3. What is the association of learning style and retention regarding race?
4. What is the association of learning style and retention when controlling for race and gender?

Methodology

Sample

The sample, 964 students, came from two private colleges and three public universities in South Carolina. The universities were public and the colleges were private. The institutions ranged from 16,000 students to 600 students. All students in this study were in their first year when selected for this longitudinal study. In the sample were 457 males and 507 females. Included in this group were 403 Blacks, 550 Whites, and 11 students of other races. The sample represented a population of approximately 8,000 young men and women.

Instrumentation

This study used the same two instruments as earlier studies. A description of the *Learning Styles Inventory* by Canfield and Knight (1983) and the *Student Demographic Questionnaire* developed by the principal investigator appeared in the

discussion under instrumentation in the study, An Investigation of the Learning Styles of First-Year Students in Colleges and Universities.

Procedures

In the spring of the 1989-90 academic year, from 10 to 15 percent of the first-year students at participating institutions took the Canfield and Knight *Learning Styles Inventory* (1983) and a *Student Demographic Questionnaire*. The students were part of the initial study on learning styles in this research.

During the fall semester, three years later, the researcher gathered retention data on the same students. The registrars at the various institutions affirmed that the students were still enrolled or were no longer in school. Although students did not sign initially the student questionnaires attached to the learning style instruments, students gave their social security numbers, a formulation base that allowed tracking of the enrollment in the same institution.

The reasons for dropping out of school were beyond the scope of this study. For instance, the study had no control for forced dropouts due to academic ineligibility or transfers to other institutions. Neither did the design control for students who may have dropped out voluntarily and then returned to school during the three-year interval.

Analysis of Data

At least four statistical procedures were of use in the analysis of data for answering the first three questions of the research. Percentages indicated the retention rate or holding power of each learning style. T-tests gave the t-values for a comparison of learning styles to determine which style was significantly different from the other styles in regard to holding power. Chi-square determined the association of learning style with retention rates.

To answer the fourth question, the research utilized statistical techniques appropriate for the analysis of categorical data such as log-linear models, with

attention being focused on the separate and possible joint effects of gender, race, and learning style on student retention. The process of model selection resulted from the hierarchical model fitting of the log-linear procedure. The hierarchical model fitting provided the basis to select a parsimonious model compared to other competing and more constrained models. This property was useful to test if one model provided a significant improvement in fit over less complicated models. Here, the difference between L^2 (log likelihood ratio chi-square) of the two models provided the test statistic for assessing the improvements in the fit of the model.

The number of students varies in the analyses. Students in the other race category were part of the analysis for total sample and for the analysis for males and females, but students of other races were not part of the analyses dealing with race.

Findings

Question 1 asked about the retention rate of students in each learner typology. Table 5-1 shows that students in the applied (80.7%) and independent/applied (80.0%) styles had higher retention rates than students in other styles. According to t-tests, however, the differences in proportion of the applied and independent/applied styles were statistically significant with the social/conceptual style only. Overall, results from the chi-square test showed no effect for learning style on retention (chi-square value = 6.458, $p > .05$).

Question 2 dealt with gender and retention as related to learning styles. Table 5-2 shows the retention rates for males and females in the various learner typologies. Excepting conceptual, applied, neutral, and independent styles of learning, the retention rate was higher for males than it was for females. Styles with high holding power for males were independent/conceptual (91.3%) and

Table 5-1

Retention Rates of Students on Various Learner Typologies

Typology	Returnees	Dropouts	Retention Rate
Social/Conceptual	99	42	70.2
Social	100	27	78.7
Social/Applied	79	25	75.9
Conceptual	88	35	71.5
Neutral Preference	79	26	75.2
Applied	70	17	80.7
Independent/Conceptual	101	27	78.9
Independent	55	19	74.3
Independent/Applied	60	15	80.0

Table 5-2

Retention Rates of Males and Females in Various Learner Typologies

Typology	Male			Female		
	Returnees	Dropouts	Retention Rate	Returnees	Dropouts	Retention Rate
Social/Conceptual	51	21	70.8	48	21	67.7
Social	57	9	86.4	43	18	70.7
Social/Applied	54	15	78.3	25	10	72.7
Conceptual	29	15	65.9	59	20	74.7
Neutral Preference	44	13	77.2	35	13	77.3
Applied	32	10	76.2	38	7	86.0
Independent/Conceptual	42	4	91.3	59	23	71.3
Independent	19	8	70.4	36	11	78.3
Independent/Applied	27	7	79.4	33	8	78.9

social (86.4%) styles. Females with the applied style (86.0%) had a higher retention rate than young women with other styles. Chi-square results for males (14.224; $p > .05$) and chi-square results for females (5.069; $p > .05$) were not significant, however.

Question 3 pertained to the association of learning style and retention in regard to race. Table 5-3 shows the retention rates in the various learner typologies for Whites and Blacks. Retention rates in each style were higher for Whites than they were for Blacks. Whereas the independent/applied style (88.2%) and the independent/conceptual style (87.7%) were high in holding power for Whites, the styles with the most holding power for Blacks were social/applied (74.1%) and applied (73.9%). Chi-square values were not significant for race; Whites had a value of 8.993 ($p > .05$), and Blacks had a value of 1.456 ($p > .05$).

Question 4 dealt with the retention rates in the various learner typologies when controlling for race and gender. Table 5-4 presents the results of a comparative model fitting for a four-way cross-classification table involving gender, race, learning style, and retention. Only logit specification models were of interest in analyzing the association among them. One can note from Table 5-4 that Model 3, consisting of the main effect of race on retention, is the preferred model.

Comparing Models 1 and 3, one notices that the race effect, ignoring the other two factors, such as gender and learning style, was significant, with difference in L^2 values being 15.97, with degrees of freedom equal 1. Similarly, comparing each of Models 5 and 7 with Model 3, the model indicated that effects of gender and learning style were not statistically significant. Hence, Model 3 was

Table 5-3

Retention Rates in Various Learner Typologies by Race

Typology	Whites			Blacks		
	Returnees	Dropouts	Retention Rate	Returnees	Dropouts	Retention Rate
Social/Conceptual	46	16	74.2	51	24	68.0
Social	68	13	84.0	32	14	69.6
Social/Applied	58	18	76.3	20	7	74.1
Conceptual	44	14	75.9	44	21	67.7
Neutral Preference	41	12	77.4	36	14	72.0
Applied	51	10	84.1	17	6	73.9
Independent/Conceptual	57	8	87.7	42	19	68.9
Independent	32	9	78.0	23	9	71.9
Independent/Applied	45	6	88.2	15	9	62.5

Table 5-4

Results of Fitting Alternate Models for the Four-Way Cross-Classification Table Involving Gender, Race, Learning Style, and Retention

Model[1]	Marginals Fitted	L^2	df	p
1	(234)(1)	44.93	35	.121
2	(234)(12)	43.31	34	.131
3*	(234)(13)	28.96	34	.713
4	(234)(14)	38.45	27	.071
5	(234)(12)(13)	28.33	33	.699
6	(234)(12)(14)	36.77	26	.078
7	(234)(13)(14)	24.79	26	.531
8	(234)(12)(13)(14)	23.89	25	.526

[1]Note: Response Factors: Retention (1); Gender (2); Race (3); Learning Style (4)
* Preferred model

preferred to other competing models. This model clearly specified that the main effect of race was significant on student retention.

Table 5-5 presents the expected frequencies along with odds and log odds. Figure 5-1 depicts the chart using these log odds on returnees relative to dropouts by gender and race. One can observe from Figure 5-1 that odds on returnees relative to dropouts for White male students were constant across all categories of learning styles. These findings mean that learning style does not affect retention behavior for White male students. Interestingly, one can note that the odds on retention for Black females who adopt the social/applied style were lower than the respective odds for Black females using other learning styles. Similarly, the odds on retention for Black male students who use independent and independent/applied learning styles were significantly lower than the similar measures for Black males using other learning styles. Specifically, White female students using the independent style showed higher retention rates when compared to counterparts following different learning styles. This finding clearly shows that learning style affects retention rates differently for Blacks and their White counterparts.

Discussion

Learning style had an association with student retention only when studied by gender within the races. The retention rates for White males remained constant across all categories of learning style. This finding suggests that White males, perhaps, have a better retention rate during this period because the retention rate for White males was higher than that for other subgroups in each learning style category, making the pattern clearly visible. White female students indicated

Table 5-5

Expected Frequencies, Odds Ratios, and Log Odds Under the Preferred Model

Race	Sex	Learning Style	Retention Status		Ratio	Odds Ratios	Log Odds
			Returnees	Dropouts		Base:Neutral	
White	Male	Social Conceptual	24.22	5.78	4.1903	0.999	-0.00055
		Social	36.33	8.67	4.1903	0.999	-0.00055
		Social Applied	39.56	9.44	4.1907	1.000	-0.00047
		Conceptual	17.76	4.24	4.1887	0.999	-0.00094
		Neutral	25.03	5.97	4.1926	1.000	0.00000
		Applied	27.45	6.55	4.1908	1.000	-0.00043
		Independent Conceptual	24.22	5.78	4.1903	0.999	-0.00055
		Independent	16.95	4.05	4.1852	0.998	-0.00178
		Independent Applied	21.80	5.20	4.1923	1.000	-0.00008
	Female	Social Conceptual	25.83	6.17	4.1864	0.999	-0.00055
		Social	29.06	6.94	4.1873	1.000	-0.00032
		Social Applied	21.80	5.20	4.1923	1.001	0.00087
		Conceptual	29.06	6.94	4.1873	1.000	-0.00032
		Neutral	17.76	4.24	4.1887	1.000	0.00000
		Applied	23.41	5.59	4.1878	1.000	-0.00020
		Independent Conceptual	28.25	6.75	4.1852	0.999	-0.00083
		Independent	16.15	3.85	4.1948	1.001	0.00146
		Independent Applied	19.37	4.63	4.1836	0.999	-0.00122
Black	Male	Social Conceptual	27.79	12.21	2.2760	1.000	-0.00024
		Social	14.59	6.41	2.2761	1.000	-0.00018
		Social Applied	13.90	6.10	2.2787	1.001	0.00094
		Conceptual	15.29	6.71	2.2787	1.001	0.00094
		Neutral	17.37	7.63	2.2765	1.000	0.00000
		Applied	5.56	2.44	2.2787	1.001	0.00094
		Independent Conceptual	9.73	4.27	2.2787	1.001	0.00094
		Independent	3.47	1.53	2.2680	0.996	-0.00377
		Independent Applied	4.86	2.14	2.2710	0.998	-0.00242
	Female	Social Conceptual	24.32	10.68	2.2772	1.000	0.00027
		Social	17.37	7.63	2.2765	1.000	0.00000
		Social Applied	4.86	2.14	2.2710	0.998	-0.00242
		Conceptual	29.88	13.12	2.2774	1.000	0.00039
		Neutral	17.37	7.63	2.2765	1.000	0.00000
		Applied	10.42	4.58	2.2751	0.999	-0.00063
		Independent Conceptual	32.66	14.34	2.2775	1.000	0.00044
		Independent	18.76	8.24	2.2767	1.000	0.00007
		Independent Applied	11.81	5.19	2.2755	1.000	-0.00044

Logit Regression of Returnees Relative to Dropouts on Learning Styles by Gender and Race

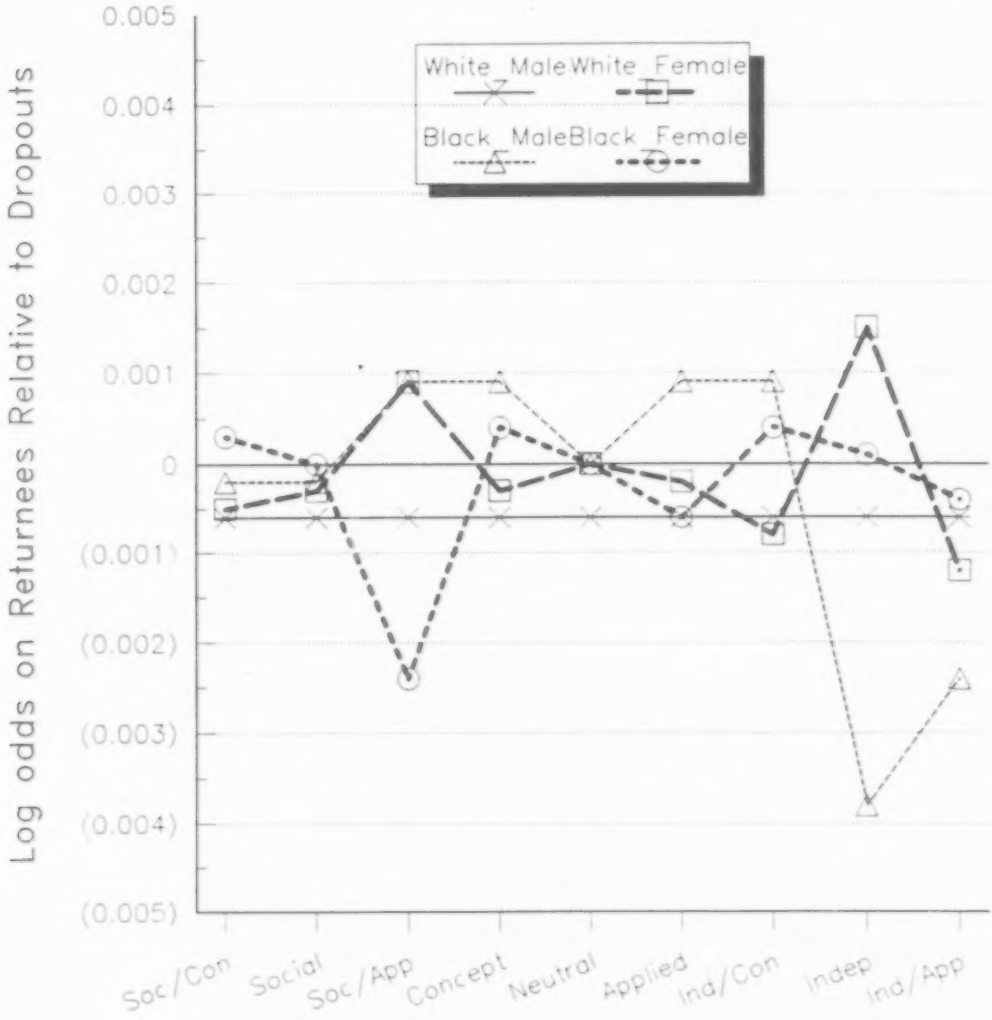

Figure 5-1.

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higher retention rates in the social/applied and independent learning styles. Black males responded more highly regarding retention for conceptual, applied, and independent/conceptual learning styles. Black females did well in retention when they used social/conceptual, conceptual, and independent/conceptual styles.

Interestingly, Black males using independent and independent/applied styles showed lower retention rates when compared with their peers following other learning styles. Likewise, for Black females, the social/applied learning style had the lowest retention when compared with other learning style categories.

The findings from the study indicate the complexity of the association of learning style and retention. Examination of undifferentiated subgroups gives misleading information because of differences in style between young men and women within the two races. A more nearly accurate association occurs when controlling for gender and race. While learning style is not an issue for White males, it is for other subgroups. Previous research findings showed that students with reflective, independent, and analytical styles had more success in school than those who were impulsive, social, and holistic (Claxton & Murrell, 1987; Guild & Garger, 1985). Yet, in this study, Black males who had independent styles had lower retention rates than other Blacks in other categories. Also, social and social/conceptual styles proved to have high holding power for Black females, an inconsistency with other findings related to social styles.

As the population of students in colleges and universities becomes more diversified, determination of styles that are helpful in improving student retention is important to college administrators and academic advisors in designing prevention and intervention programs. Moreover, these findings are equally important for assisting college and university instructors in understanding the learning styles of all components within the classroom. Hence, instructors can design curriculum, instruction, and evaluation procedures that will meet the needs

of student groupings and thus improve learning and performance as well as reinforce the desire to remain in school.

Chapter 6

Phase IV - An Investigation of the Learning Styles of Secondary Students

Introduction

This investigation in the series of studies on learning style focused on secondary students. The research examined the learning styles of secondary students to determine answers to several questions. The questions were:

1. What are the learning style characteristics of secondary students concerning condition of learning, area of interest, and mode of learning?
2. What are the learner typologies of secondary students?
3. Do differences in learning style exist in relationship to socioeconomic status and grade level?
4. Do learning style and academic achievement have an association?
5. How do secondary students compare with postsecondary students concerning style?

Methodology

Sample

The sample had 6,207 students from 19 secondary schools in one Southern state with a complex social and economic structure. Sixteen of these schools were public, and three were private. The schools ranged in size from a high of 2,000 to a low of 350 students. The sample, consisting of approximately 10 percent of the student body in the selected schools, represented a total population of approximately 60,000 young men and women. Although the schools were not randomly selected, the schools were from various geographical areas of the state including the Northern Region, Southern Region, and Midlands.

The sample had 3,052 males and 3,155 females, ages 13 to 20. Included in this group were 2,705 Blacks, 3,351 Whites, and 151 students of other racial backgrounds. The sample had 1,646 ninth graders, 1,643 tenth graders, 1,414 eleventh graders, and 1,478 twelfth graders with complete instruments for analysis.

The majority of students were from the upper socioeconomic status, with 4,661 children either purchasing lunch at school or bringing lunch from home. Only 1,483 children were participants in a free or reduced price school lunch program. Another indicator of high status was the educational level of the mother; 1,790 of the mothers had an associate or higher college degree and 2,341 had a secondary school diploma. Only 828 students came from homes where the mother had less than a secondary school education. Also, most of the students had two or less siblings in the family; 2,070 children lived in homes with more than four children.

Instrumentation

Learning Styles Inventory. This study with secondary students used the Canfield *Learning Styles Inventory*, as did all of the studies with postsecondary students. A description of the instrument appeared in Chapter 3 of the document.

Student Demographic Questionnaire. The researcher constructed a student demographic questionnaire to describe characteristics of the sample and to have information about the student to examine associations of learning style with family and student variables (see Appendix A-2). Responses to the questionnaire provided pertinent information, such as gender, age, grade level, race, mother's and father's educational level, school lunch status, and perceived academic achievement.

Procedures

During the 1992-93 academic year, the researcher contacted schools in the Midlands, as well as the Northern and Southern regions of the state, to seek

participation with the learning style study. While 16 of the schools that volunteered were public, three were private.

These schools received the list of requirements for collaboration as well as a summary of the research objectives and methodology for the Research Committee to approve. For instance, the study required that assessment with the learning style instrument and data questionnaire take place during an English class. Another requirement was that the Head of the English Department set up a schedule for each grade that included a span of classes from remedial to advanced for research assistants to administer the learning style inventory and data questionnaire. Assessment in schools occurred between October and April. Staff from the research office administered the inventories and data questionnaires within the classroom, usually with the teacher present. Before accepting materials from students, research assistants checked forms for incomplete responses, requesting that students complete the items omitted.

After administration of the learning style inventories and data questionnaires, research assistants prepared the data for entry in the computer. Personnel from the 1890 Research Statistical and Data Management Laboratory analyzed the data.

Analysis of Data

Selected statistical procedures comprised the analyses for this research. To answer Question 1 related to learning style characteristics, the researcher computed means and standard deviations for condition of learning, area of interest, and mode of learning for the total number of students as well as subgroups of race, gender, and gender by race. Then, the analysis of variance procedure determined main effects and interaction effects of groups for the learner characteristics.

For Question 2, percentages showed the proportion of students in various learner typologies. A series of t-tests determined styles that were significantly different from other styles. The examination of learner typology and various

subgroups (gender, race, socioeconomic status, or grade level) in Question 3 used the chi-square technique. The report shows, also, percentages of students in the various learner typologies for each of the variables.

The procedure for Question 4 (association of learner typology and perceived academic achievement) was the analysis of variance. The *post hoc* test was the Student-Newman-Keals procedure.

In Question 5, a series of t-tests determined significant differences between the proportion of secondary students and the proportion of postsecondary students in each specific learner typology. Also, for this comparison, the researcher examined students with regard to each continuum. The categories on the social to independent continuum were social, neutral preference, and independent, and on the other continuum, the categories were applied, neutral preference, and conceptual. T-tests determined significant differences between proportions in these various categories, also.

Findings

Learning Style Characteristics

Question 1 dealt with the characteristics of secondary students relative to condition of learning, area of interest, and mode of learning. Table 6-1 presents the number of students and means for each category. In condition of learning, high preference areas were instructor, organization, and peer, while low preference areas were independence, competition, authority, and goal setting. In other words, students like instructor's help, organized materials, and learning with peers. Students dislike independent study, competitive situations, goal setting, and authority. In area of interest, high preference was working with inanimate objects, followed by working with people, numerics (numbers), and qualitative (language-oriented work). The high preference areas for mode of learning were direct

Table 6-1

Number of Students and Mean Scores for Condition of Learning, Area of Interest, and Mode of Learning

Characteristics of Style	Number	Mean[1]
Condition of Learning		
Peer	6207	13.47
Organization	6207	13.40
Goal Setting	6207	15.67
Competition	6207	17.20
Instructor	6207	11.92
Detail	6207	14.05
Independence	6207	18.10
Authority	6207	15.67
Area of Interest		
Numeric	6207	15.62
Qualitative	6207	15.79
Inanimate	6207	14.09
People	6207	14.24
Mode of Learning		
Listening	6207	16.31
Reading	6207	17.74
Iconic	6207	13.18
Direct Experience	6207	12.51

[1] Scores are ranks. Lower values signify higher preferences.

experience and iconic (visuals), and low preference areas were listening and reading.

Of interest were gender and race differences and interaction effects of race and gender on learning style characteristics. Table 6-2 shows the mean scores and standard deviations for Blacks and Whites as well as males and females. Table 6-3 indicates the mean scores and standard deviations for race by gender for condition of learning, area of interest, and mode of learning.

One can see on Table 6-4 the results of the analysis of variance for gender and race on condition of learning. With the exception of instructor, significant differences exist between males and females on all characteristics. Males had higher preferences for goal setting and competition, but females had higher preferences for peer, organization, detail, independence, and authority. Blacks and Whites differed on peer, competition, instructor, detail, independence, and authority. While Blacks had a higher preference for competition, detail, and authority, Whites were higher on their choices for independence, learning with peers, and interaction with the instructor.

Table 6-5 shows the results of the analysis of variance for area of interest by gender and race. There are significant gender differences for numeric, qualitative, inanimate, and people. Males preferred mathematics and inanimate objects while females preferred language-oriented activities and people. The races differed on numeric, qualitative, inanimate, and people, also. Blacks had high preference for numerics and qualitative experiences and Whites had high preferences for inanimate objects and people.

Table 6-6 shows the results of the analysis of variance for mode of learning by gender and race. Sex differences occurred in reading and iconics with females selecting reading more often than males, and males selecting visuals more often than females. Race differences occurred in reading, iconic, and direct experience.

Table 6-2

Means and Standard Deviations by Gender and Race for Learning Style Characteristics

	Gender				Race			
	Male (N=3052)		Female (N=3155)		Black (N=2705)		White (N=3351)	
Characteristics of Style	Mean[1]	S.D.	Mean[1]	S.D.	Mean[1]	S.D.	Mean[1]	S.D.
Condition of Learning								
Peer	13.60	3.31	13.33	3.15	13.58	3.19	13.38	3.23
Organization	13.95	3.16	12.86	3.06	13.36	3.06	13.43	3.21
Goal Setting	15.18	3.36	16.16	3.14	15.77	3.10	15.61	3.39
Competition	16.91	3.14	17.49	2.97	17.10	3.02	17.31	3.07
Instructor	11.83	3.43	12.00	3.39	12.58	3.34	11.37	3.34
Detail	14.30	3.07	13.81	3.13	13.58	2.92	14.46	3.18
Independence	17.28	3.88	18.90	3.45	18.56	3.38	17.76	3.97
Authority	16.24	3.63	15.12	3.46	15.08	3.37	16.15	3.65
Area of Interest								
Numeric	14.96	4.02	16.25	4.33	15.17	3.91	16.00	4.41
Qualitative	17.13	3.91	14.50	4.01	15.26	3.83	16.23	4.37
Inanimate	12.13	3.98	16.00	4.01	14.39	4.00	13.86	4.73
People	15.43	3.63	13.08	3.65	14.98	3.48	13.65	3.94
Mode of Learning								
Listening	16.30	3.70	16.33	3.76	16.13	3.66	16.46	3.75
Reading	17.91	4.08	17.56	4.01	16.49	3.86	18.76	3.89
Iconic	13.00	3.71	13.36	3.71	13.75	3.72	12.73	3.63
Direct Experience	12.44	3.86	12.57	3.84	13.42	3.77	11.79	3.72

[1]Scores are ranks. Lower values signify higher preferences.

Table 6-3

Number of Students, Mean Scores, and Standard Deviations for Males and Females within Races

	Gender by Race							
	Male-Black (N=1241)		Male-White (N=1726)		Female-Black (N=1464)		Female-White (N=1625)	
Characteristic of Style	Mean[1]	S.D.	Mean[1]	S.D.	Mean[1]	S.D.	Mean[1]	S.D.
Condition of Learning								
Peer	13.49	3.25	13.70	3.29	13.65	3.14	13.04	3.12
Organization	13.96	3.04	13.96	3.20	12.85	2.99	12.86	3.12
Goal Setting	15.44	3.17	15.00	3.42	16.05	3.02	16.26	3.24
Competition	16.83	3.04	17.02	3.14	17.33	2.98	17.63	2.95
Instructor	12.36	3.37	11.43	3.37	12.77	3.31	11.30	3.31
Detail	13.94	2.90	14.60	3.10	13.27	2.91	14.31	3.25
Independence	17.89	3.53	16.87	4.02	19.13	3.14	18.69	3.70
Authority	15.52	3.45	16.78	3.60	14.70	3.25	15.48	3.59
Area of Interest								
Numeric	14.57	3.76	15.26	4.14	15.68	3.97	16.77	4.55
Qualitative	16.63	3.50	17.53	4.09	14.10	3.71	14.85	4.23
Inanimate	12.57	3.59	11.79	4.17	15.93	3.68	16.06	4.29
People	15.94	3.36	15.11	3.69	14.17	3.37	12.09	3.59
Mode of Learning								
Listening	16.01	3.59	16.51	3.69	16.24	3.71	16.41	3.80
Reading	16.71	3.90	18.83	3.92	16.31	3.82	18.68	3.86
Iconic	13.48	3.75	12.64	3.60	13.98	3.68	12.82	3.67
Direct Experience	13.51	3.72	11.70	3.72	13.35	3.81	11.87	3.72

[1]Scores are ranks. Lower values signify higher preferences.

Table 6-4

Results of Analysis of Variance for Condition of Learning by Gender and Race

Condition of Learning	Source	Sum of Squares	DF	F Value
Peer	Main Effects			
	Gender	135.196	1	13.19***
	Race	68.459	1	6.68**
	2-Way Interaction			
	Gender x Race	251.780	1	24.57***
Organization	Main Effects			
	Gender	1830.690	1	191.00***
	Race	.085	1	.01**
	2-Way Interaction			
	Gender x Race	.001	1	.00
Goal Setting	Main Effects			
	Gender	1409.561	1	135.44***
	Race	15.674	1	1.51
	2-Way Interaction			
	Gender x Race	153.030	1	14.70***
Competition	Main Effects			
	Gender	472.105	1	51.35***
	Race	91.201	1	9.92**
	2-Way Interaction			
	Gender x Race	4.000	1	.43
Instructor	Main Effects			
	Gender	18.168	1	1.63
	Race	2165.568	1	194.20***
	2-Way Interaction			
	Gender x Race	108.728	1	9.75**
Detail	Main Effects			
	Gender	320.355	1	34.30***
	Race	1,077.686	1	115.37***
	2-Way Interaction			
	Gender x Race	53.165	1	5.69**
Independence	Main Effects			
	Gender	3685.610	1	278.95***
	Race	768.178	1	58.14***
	2-Way Interaction			
	Gender x Race	122.895	1	9.30**
Authority	Main Effects			
	Gender	1782.108	1	146.86***
	Race	1523.521	1	125.55***
	2-Way Interaction			
	Gender x Race	88.613	1	7.30**

* $p < .05$; ** $p < .01$; *** $p < .001$

Table 6-5

Results of Analysis of Variance for Area of Interest by Gender and Race

Area of Interest	Source	Sum of Squares	DF	F Value
Numeric	Main Effects			
	Gender	2676.578	1	155.94***
	Race	1213.760	1	70.71***
	2-Way Interaction			
	Gender x Race	58.325	1	3.40
Qualitative	Main Effects			
	Gender	10292.173	1	668.55***
	Race	995.073	1	64.64***
	2-Way Interaction			
	Gender x Race	7.923	1	.52
Inanimate	Main Effects			
	Gender	22567.476	1	1429.21***
	Race	140.971	1	8.93**
	2-Way Interaction			
	Gender x Race	316.285	1	20.03***
People	Main Effects			
	Gender	9149.292	1	738.51***
	Race	3237.833	1	261.35***
	2-Way Interaction			
	Gender x Race	579.374	1	46.77***

* $p < .05$
** $p < .01$
*** $p < .001$

Table 6-6

Results of Analysis of Variance for Learning Style and Mode of Learning by Gender and Race

Mode of Learning	Source	Sum of Squares	DF	F Value
Listening	Main Effects			
	Gender	2.824	1	.21
	Race	161.655	1	11.77***
	2-Way Interaction			
	Gender x Race	38.900	1	2.83
Reading	Main Effects			
	Gender	103.797	1	6.90**
	Race	7546.992	1	502.06***
	2-Way Interaction			
	Gender x Race	20.655	1	1.37
Iconic	Main Effects			
	Gender	159.003	1	11.82***
	Race	1498.863	1	111.43***
	2-Way Interaction			
	Gender x Race	37.645	1	2.80
Direct Experience	Main Effects			
	Gender	.572	1	.04
	Race	4002.320	1	285.72***
	2-Way Interaction			
	Gender x Race	40.505	1	2.89

* $p < .05$
** $p < .01$
*** $p < .001$

While Blacks preferred the reading mode, Whites preferred direct experiences and iconics.

For condition of learning, there were interaction effects for gender by race for peer (high preference for White females and Black males), goal setting (high preference for Black males and low preferences for White females), instructor (high preference for White females), detail (high preference for Black females), independence (high preference for White males), and authority (high preference for Black males and White females). In area of interest, inanimate (high preference for White males) and people (high preference for White females) had an interaction effect for race and gender. There were no interaction effects on mode of learning for gender and race.

Learner Typologies

Question 2 asked about learner typologies derived from learning style characteristics. Table 6-7 gives the number and percentage of students in each learner typology. When examining the overall sample, one notes that the highest number of students (16.9%) was in the social category, followed by social/applied (14.3%). The smallest numbers of students were in the independent combinations: independent/applied (8.9%) and independent/conceptual (7.0%). In terms of the two continua, more students were social than independent, and more students were applied than conceptual. Some students were in each of the learner typologies.

Further analyses by t-tests on proportions determined which categories were significantly different from other categories. For instance, the social, social/applied, and independent/conceptual styles are significantly different from each of the other styles. Social/conceptual is significantly different from all other styles except neutral preference, applied, and independent. Conceptual is significantly different from social/conceptual, social, social/applied, neutral, and independent/conceptual. Independent/applied is significantly different from other

Table 6-7

Number and Percentage of Students in Various Learning Styles

	Total	
Learning Style	**Number**	**Percentage**
Social	1050	16.9
Social/Applied	887	14.3
Neutral Preference	749	12.0
Social/Conceptual	702	11.3
Applied	654	10.5
Independent	596	9.6
Conceptual	566	9.1
Independent/Applied	552	8.9
Independent/Conceptual	433	7.0

styles with the exception of conceptual, applied, and independent. Neutral preference is different from all other styles except social/conceptual and applied, but applied is different only from social, social/applied, and independent/conceptual. Independent differed from four categories: social, social/applied, neutral, and independent/conceptual.

Association of Learner Typology with Socioeconomic Status and Grade Level

Question 3 dealt with the relationship of learner typology to socioeconomic status and grade level. The following information describes the findings for each variable.

As indicated, the association of socioeconomic status and learning style was of interest. Table 6-8 presents the number, percentage, and rank order of students in various learner typologies by socioeconomic status. The chi-square results (chi-square = 115.99, $p < .05$) showed a difference in proportion of students in the various categories that were classified as having high socioeconomic status (brought

lunch from home or purchased lunch at school) and students having low socioeconomic status (free or partially free lunch at school). The rank order of students in the categories shows patterns of choice in learning style. Although some students were in each category, students who received free or partially free lunch were more conceptual (35.1%) than applied (23.2%) on the applied to conceptual continuum. Higher socioeconomic counterparts were more applied (37.1%) than conceptual (25.0%). Both groups had similar patterns on the social to independent continuum with both high and low status students having more social styles than independent styles.

Another area of investigation was the association of learning style and grade level. Table 6-9 shows the number, percentage, and rank order of students in each learner typology for students in Grades 9 through 12. Chi-square results indicated a significant difference between grade level and the learning style preferences of students (chi-square = 45.42, $p < .05$). Although the number of students in categories differed, no maturational patterns were in evidence, however. The similarity of patterns is apparent when one observes the rank order for each grade and makes comparisons with other grades. The most preferred categories among students in the grades were social and social/applied.

Association of Learning Style and Academic Achievement

Question 4 asked about the association between learning style and academic achievement. Academic achievement was operationalized as students' self-ratings as learners. The students rated themselves as Excellent (5), Good (4), Average (3), Fair (2), or Poor (1). The assigned numbers on the ratings provided the scores for means in the various calculations.

Table 6-10 shows the means on perceived academic achievement (self-ratings). Students with the social and combination social typologies rated themselves higher

Table 6-8

Number and Percentage of Students in Various Learning Styles by Socioeconomic Status

	High Socioeconomic Status			Low Socioeconomic Status		
Learning Style	Number	Percentage	Rank Order	Number	Percentage	Rank Order
Social/Conceptual	480	69.0	5.0	216	31.0	2.0
Social	795	76.3	1.0	247	23.7	1.0
Social/Applied	729	82.9	2.0	150	17.1	6.0
Conceptual	390	69.9	8.0	168	30.1	4.0
Neutral Preference	541	73.0	3.0	200	27.0	3.0
Applied	542	84.2	4.0	102	15.8	8.0
Independent/Conceptual	293	68.5	9.0	135	31.5	7.0
Independent	420	71.3	7.0	169	28.7	5.0
Independent/Applied	451	83.2	6.0	91	16.5	9.0

Table 6-9

Number and Percentage of Students by Grade in Various Learning Styles

	Learning Style								
	Soc/ Conc	Social	Soc/ App	Conc	Neu Pref	App	Indep/ Conc	Indep	Indep/ App
9th Grade									
N[1]	195	299	225	149	200	188	114	149	128
P[2]	11.8	18.2	13.7	9.1	12.2	11.4	6.9	9.0	7.8
R[3]	4	1	2	6	3	5	9	7	8
10th Grade									
N	169	271	215	156	215	185	107	179	146
P	10.3	16.5	13.1	9.5	13.1	11.3	6.5	10.8	8.9
R	6	1	2.5	7	2.5	4	9	5	8
11th Grade									
N	167	217	199	126	188	122	108	134	153
P	11.8	15.3	14.1	8.9	13.3	8.6	7.6	9.5	10.8
R	4	1	2	7	3	8	9	6	5
12th Grade									
N	170	262	247	135	145	159	102	134	124
P	11.5	17.7	16.7	9.5	9.8	10.8	6.9	9.1	8.4
R	3	1	2	6.5	5	4	9	6.5	8

[1]Number of Students
[2]Percentage of Students within Grades in Various Styles
[3]Rank Order of Styles within Grades

Table 6-10

Number of Students, Means on Perceived Academic Achievement, and Standard Deviations for Learner Typologies

Learning Style	Number	Mean	Standard Deviation
Social/Conceptual	699	3.49	.80
Social	1048	3.46	.82
Social/Applied	886	3.45	.84
Conceptual	563	3.39	.84
Neutral Preference	743	3.29	.86
Applied	653	3.24	.83
Independent/Conceptual	431	3.35	.89
Independent	590	3.21	.88
Independent/Applied	551	3.28	.91

in achievement than did students with applied, independent, and independent/applied typologies.

Results from the analysis of variance (see Table 6-11) indicate learning style has a main effect on self-ratings of students on perceived academic achievement. *Post hoc* tests show that students in the typologies of independent and applied rated themselves significantly lower than students in the conceptual, social/applied, social, and social/conceptual styles. Students in the categories of independent/applied and neutral rated themselves significantly lower than students in the categories of social/applied, social, and social/conceptual style. Students

Table 6-11

Results of Analysis of Variance for Learner Typology and Perceived Academic Achievement

Source of Variation	Sum of Squares	DF	F Value
Main Effects			
Learning Style	61.005	8	10.60***

* $p < .05$; ** $p < .01$; *** $p < .001$

with the independent/conceptual typology perceived their achievement to be significantly lower than counterparts in the social/conceptual. In summation, the data indicate that students with conceptual and social styles rated themselves higher than their counterparts in other typologies.

Comparison of Students in Learner Typologies at Secondary and Postsecondary Levels

The last question, Question 5, in the examination of secondary students dealt with a comparison of learner typologies between secondary students and postsecondary students. The postsecondary students for this investigation are the same people as those students described in Chapters 3 and 4 of the document.

Table 6-12 shows the number and percentage of students as well as t-values for each of the nine learner typologies. Only two styles differed significantly. The conceptual typology and the independent/conceptual typology have more postsecondary students than secondary students in the two categories. When the two continua are examined, no significant differences occur among the three

Table 6-12

Results of T-Tests on Proportions of Postsecondary Students vs. Secondary Students

	Postsecondary		Secondary		
Learner Typology	Number	Percentage	Number	Percentage	T-Value
Social/Conceptual	374	15.3	702	11.3	1.877
Social	339	13.8	1050	17.0	-1.390
Social/Applied	243	9.9	887	14.3	-1.786
Conceptual	337	13.8	566	9.1	2.196*
Neutral Preference	271	11.1	749	12.1	-0.437
Applied	202	8.3	654	10.6	-0.950
Independent/Conceptual	300	12.3	433	7.0	2.445*
Independent	232	9.5	596	9.6	-0.044
Independent/Applied	150	6.1	552	8.9	-1.102

* Significant at .05 level

categories on the social to independent continuum; however, differences on all categories of the applied to conceptual continuum are significant (see Table 6-13). Postsecondary students are more conceptual than are secondary students, and secondary students are more applied than are postsecondary students. Also, a higher percentage of secondary students than postsecondary students are in the neutral category, a category that indicates no definite allegiance to any of the styles.

Discussion

The examination of secondary students' learning styles revealed six important findings. The first significant finding was that subgroups differ in learning style characteristics. Males have high preferences for goal setting, competition,

Table 6-13

Results of Proportional T-Tests for Postsecondary Students vs Secondary Students on Two Continua by Category

	Postsecondary		Secondary		
Learning Style Continua	**Number**	**Percentage**	**Number**	**Percentage**	**T-Value**
Soc to Indep Continuum					
All Social	956	39.1	2639	42.4	-1.774
Neutral Preference	810	33.4	1998	32.1	0.513
All Independent	682	27.9	1581	25.4	1.242
Conc to App Continuum					
All Conceptual	1011	41.3	1701	27.4	7.468***
Neutral Preference	842	34.4	2424	39.0	-2.371*
All Applied	595	24.3	2093	33.7	-4.351***

* Significant at .05 level; ** Significant at .01 level; *** Signficant at .001 level

independence, numeric, inanimate, and iconic while females have high preferences for peer, organization, detail, authority, qualitative, and people. Race differences occurred on all scales in area of interest and mode of learning and on six of eight scales in condition of learning. Blacks preferred competition, detail, authority, numeric, qualitative, listening, and reading and Whites preferred peer, instructor, independence, inanimate, people, iconic, and direct experience. There were also race and gender interactions on six characteristics in the category of condition of learning and two characteristics in area of interest. Learning with peers was high for White females and Black males. Black females preferred detail. White males preferred their independence while working with objects. Black males and White females liked authority.

The second important finding was that the social and social combination learner typologies, calculated from the learning style characteristics, were the predominant styles for secondary students. Few students had independent typologies.

The effect of socioeconomic status on learner typology was the third important finding. High socioeconomic status students followed the applied styles more often than did low socioeconomic status students. Both groups had similar patterns on the social to independent continuum; they preferred social styles to independent styles.

The fourth important finding was that learning style is fairly stable over time. The pattern in learning styles across Grades 9 through 12 was similar, meaning no maturational effects were in evidence.

Learning style does affect self-ratings on achievement, the fifth important finding. Students with social and social combination styles rated themselves higher on perceived academic achievement than did their counterparts in other learner typologies. Students' self-ratings probably reflect the reward system in secondary schools in which certain specific styles of learning are valued over other specific styles.

The last finding of importance was in regard to the comparison of learning styles of secondary students with those of postsecondary students. The groups differed in only two categories: conceptual and independent/conceptual. It appears that a large proportion of students in the conceptual categories go to college or the university. Secondary schools had more students in the applied typologies than conceptual typologies. The discrepancy between secondary and postsecondary may be due in part to more females (1,320) than males (1,109) in the postsecondary sample. Females have more conceptual styles than males have.

The findings from this study show the complex nature of the learning style phenomenon. Subgroups have different learning style characteristics; instruction, curriculum, and services cannot be adjusted to just males vs. females or Blacks vs. Whites. Learners must be considered as individuals. The most effective change administrators and teachers could make in the secondary school is an attitudinal change. All learner typologies need to be valued as effective styles of learning. Schools that value all styles adjust the organization and delivery systems proportionately to the various styles. When instruction is adjusted proportionately, each student is comfortable for certain periods (instruction matches his or her style) and is uncomfortable (instruction mismatches his or her style, but the student learns to accommodate to other style of teaching) for specific other periods of time. This structuring may take place within the content areas.

Another implication of the research is for administrators and teachers to instruct students about their strengths and weaknesses related to their learner typology. The findings clearly show that learning style is fairly stable throughout the secondary school years. Knowledge of one's style could help a student use his or her strengths to perform at maximum potential, thus increasing the quality of life.

CHAPTER 7

INVESTIGATION OF LEARNING STYLE IN RELATION TO GENDER AND RACE

Introduction

The last investigation used the two independent samples from previous studies, that is, the total sample from colleges and universities and the total sample from high schools. The purpose of the study was to examine gender and race as they related to learner typology. Because a description of the two samples as well as the *Learning Styles Inventory* appeared earlier in the document, there is no description here.

Specific questions to be examined were:

1. Do differences in learning style exist between males and females in postsecondary and secondary settings?
2. Do differences in learning style exist between Black and White students at the two levels?
3. Are there interaction effects of race and gender for postsecondary students and secondary students?

Findings

The first question asked about gender differences in learning style at postsecondary and secondary levels. Table 7-1 shows the number and percentage of students in each learner typology for both groups. The chi-square statistical procedure showed a significant difference between males and females at colleges and universities (chi-square = 78.14; $p < .05$) and at high schools (chi-square = 122.54; $p < .05$). *Post hoc* tests on proportions identified the typologies that were

Table 7-1

Number and Percentage of Students in Learner Typologies by Gender

	Postsecondary				Secondary			
	Male		Female		Male		Female	
Learner Typology	**N[1]**	**P[2]**	**N**	**P**	**N**	**P**	**N**	**P**
Social/Conceptual	184	49.7	186	50.3	296	42.2	406	57.8
Social	179	53.3	157	46.7	493	47.0	556	53.0
Social/Applied	157	65.1	84	34.9	508	57.4	377	42.6
Conceptual	124	37.0	211	63.0	223	39.5	342	60.5
Neutral Preference	121	44.6	150	55.4	343	45.9	405	54.1
Applied	88	44.2	111	55.8	384	58.8	269	41.2
Independent/Conceptual	100	33.7	197	66.3	184	42.5	249	57.5
Independent	96	41.7	134	58.3	275	46.2	320	53.8
Independent/Applied	60	40.0	90	60.0	327	59.7	221	40.3

[1]Number of Students
[2]Percentage of Students

significantly different from the other typologies. In the college sample, styles that were different for males and females were social (t-value = 2.99, $p < .05$), social/applied (t-value = 6.39, $p < .05$), conceptual (t-value = -3.42, $p < .05$), and independent/conceptual (t-value = -4.42, $p < .05$). Males had more social and social/applied styles while females had more conceptual and independent/conceptual typologies in colleges and universities. In high school, all typologies differed significantly with the exception of two: social and independent. Females had more social/conceptual (t-value = -3.84, $p < .05$) and conceptual (t-

value = -4.76, $p < .05$) styles than did males. However, males had more social/applied (t-value = 5.27, $p < .05$), neutral preference (t-value = -1.93, $p < .05$), applied (t-value = 5.23, $p < .05$), independent/conceptual (t-value = -2.77, $p < .05$), and independent/applied (t-value = 5.25, $p < .05$) styles.

Question 2 related to race and learning style. Table 7-2 gives the number and percentage of Black and White students by setting. Significant race differences existed in the postsecondary setting (chi-square = 134.16; $p < .05$) and the secondary setting (chi-square = 327.07; $p < .05$). Black postsecondary students had more social/conceptual (t-value = 5.05, $p < .05$), conceptual (t-value = -5.10, $p < .05$), and independent/conceptual (t-value = -5.17, $p < .05$) styles than White counterparts had. White postsecondary students, however, had more social/applied (t-value = 6.03, $p < .05$), applied (t-value = 5.39, $p < .05$), and independent/applied (t-value = 3.85, $p < .05$) styles than did Blacks. The pattern for secondary school varied somewhat from the postsecondary pattern. When compared to White secondary school students, Black secondary school students had more social/conceptual (t-value = -6.45, $p < .05$), conceptual (t-value =-7.36, $p < .05$), and independent (t-value = -5.17, $p < .05$) styles like postsecondary students, but they also had more neutral preference (t-value = 2.83, $p < .05$) and independent (t-value = -4.59, $p < .05$) styles. Like the postsecondary group, Whites continued to have more students in the applied styles (social/applied: t-value = 10.27, $p < .05$; applied: t-value = 7.38, $p < .05$; independent/applied: t-value = 7.44, $p < .05$) than did their Black counterparts. Therefore, the social style was the only style with no significant difference between the races on the secondary school level and social, neutral, and independent were the only styles with no differences on the postsecondary level.

Table 7-2

Number and Percentage of Students in Learner Typologies by Race

	Postsecondary				Secondary			
	White		Black		White		Black	
Learner Typology	N[1]	P[2]	N	P	N	P	N	P
Social/Conceptual	146	40.3	216	59.7	300	43.7	386	56.3
Social	187	55.8	148	44.2	556	54.3	467	45.7
Social/Applied	171	71.3	69	28.8	614	71.4	246	28.6
Conceptual	131	39.6	200	60.4	224	40.5	329	59.5
Neutral Preference	136	50.7	132	49.3	369	50.3	365	49.7
Applied	138	71.1	56	28.9	445	69.1	199	30.9
Independent/Conceptual	124	42.5	168	57.5	181	43.3	237	56.7
Independent	130	57.3	97	42.7	268	46.4	309	53.6
Independent/Applied	101	67.8	48	32.2	379	70.6	158	29.4

[1] Number of Students
[2] Percentage of Students

Question 3 dealt with interaction effects of gender and race. Table 7-3 shows the numbers and percentages of Blacks and Whites, as well as males and females, in the postsecondary setting. Table 7-4 reports similar information for the secondary setting. Chi-square results indicate significant interaction effects for both the postsecondary setting (chi-square = 224.90, $p < .05$) and the secondary setting (chi-square = 482.36, $p < .05$). Table 7-5 shows t-values from *post hoc* tests for groups of postsecondary students in learner typologies. The asterisk indicated t-values for groups that are significantly different from other groups. Black males differed from the other three groups (White males, White

Table 7-3

Number and Percentage of Postsecondary Students in Learner Typologies by Gender and Race

	Male				Female			
	White		Black		White		Black	
Learner Typology	N[1]	P[2]	N	P	N	P	N	P
Social/Conceptual	75	11.6	104	23.3	71	11.5	112	16.3
Social	104	16.1	75	16.8	83	13.4	73	10.6
Social/Applied	109	16.9	47	10.5	62	10.0	21	3.1
Conceptual	55	8.5	65	14.6	76	12.3	135	19.7
Neutral Preference	64	9.9	56	12.6	72	11.6	76	11.1
Applied	65	10.1	20	4.5	73	11.8	36	5.2
Independent/Conceptual	56	8.7	41	9.2	68	11.0	127	18.3
Independent	69	10.7	25	5.6	61	9.8	72	10.5
Independent/Applied	47	7.3	13	2.9	54	8.7	35	5.1

[1] Number of Students
[2] Percentage of Students

Table 7-4

Number and Percentage of Secondary Students in Learner Typologies by Gender and Race

	Male				Female			
	White		Black		White		Black	
Learner Typology	**N[1]**	**P[2]**	**N**	**P**	**N**	**P**	**N**	**P**
Social/Conceptual	121	7.1	166	13.4	179	11.1	220	15.1
Social	240	14.0	240	19.4	315	19.5	27	15.5
Social/Applied	339	19.8	152	12.3	275	17.0	95	6.4
Conceptual	96	5.6	121	9.8	128	7.9	208	14.2
Neutral Preference	174	10.1	162	13.1	195	12.1	203	13.9
Applied	270	15.7	111	9.0	175	10.8	88	6.0
Independent/Conceptual	92	5.4	84	6.8	89	5.5	153	10.5
Independent	136	7.9	128	10.4	132	8.2	181	12.4
Independent/Applied	248	14.5	71	5.7	130	8.0	87	6.0

[1] Number of Students
[2] Percentage of Students

Table 7-5

T-Values for Proportions of Postsecondary Students for Various Learner Typologies by Gender and Race

Learner Typology		Black Male	Black Female	White Male
	Black Female	2.931*		
Social/Conceptual	White Male	5.131*	2.468*	
	White Female	5.128*	2.496*	0.056
	Black Female	3.028*		
Social	White Male	0.307	-2.957*	
	White Female	1.541	-1.560	1.352
	Black Female	5.119*		
Social/Applied	White Male	-2.969*	-8.471*	
	White Female	0.266	-5.099*	1.352
	Black Female	-2.198*		
Conceptual	White Male	3.165*	5.836*	
	White Female	1.092	3.627*	-2.216*
	Black Female	0.768		
Neutral Preference	White Male	1.401	0.713	
	White Female	0.495	-0.285	-0.976
	Black Female	-0.532		
Applied	White Male	-3.388*	-3.377*	
	White Female	-4.162*	-4.311*	-0.968
	Black Female	-4.302*		
Independent/Conceptual	White Male	0.285	5.187*	
	White Female	-0.956	3.798*	-1.373
	Black Female	-2.878*		
Independent	White Male	-2.951*	-0.118	
	White Female	-2.487*	0.418	0.527
	Black Female	-1.797		
Independent/Applied	White Male	-3.133*	-1.668	
	White Female	-3.852*	-2.580*	-0.918

* $p < .05$

females, and Black females) on social/conceptual and independent styles with a high percentage of learners in conceptual, and White males and females on applied and independent/applied. Black females differed from White males and White females in five areas: social/conceptual, social/applied, conceptual, applied, and independent/conceptual. Also, Black females differed from White males on social and White females on independent/applied. The average Black postsecondary student is extremely conceptual and slightly more independent than social. In addition to differences already noted about White males, White males differed from White females on conceptual styles, with males much more applied on the conceptual to applied continuum. The average White postsecondary female is slightly more social than independent and slightly more conceptual than applied.

Table 7-6 shows the results of *post hoc* t-tests on proportions of secondary students by race and gender in the various learner typologies. The asterisk shows pairs that are significantly different from each other. Black males differ from both male and female White students on independent/applied and independent, and they differ from all three groups on social/applied. In the social/conceptual category, Black males differed from White males, and in the social, conceptual, and applied categories, they differed from Black females and White males. Black males also differed from Black females in the independent/conceptual category and White males in the neutral category. Black females differed from White males and females in the categories of social/conceptual, social/applied, conceptual, applied, independent/conceptual, independent, and independent/applied categories. White females are social and conceptual while White males are applied and to some degree independent.

Table 7-6

T-Values for Proportions of Secondary Students for Various Learner Typologies by Gender and Race

Learner Typology		Black Male	Black Female	White Male
	Black Female	-1.256		
Social/Conceptual	White Male	5.695*	7.247*	
	White Female	1.867	3.296*	-4.025
	Black Female	2.668*		
Social	White Male	3.922*	1.190	
	White Female	-0.067	-2.910*	-4.259*
	Black Female	5.306*		
Social/Applied	White Male	-5.394*	-10.968*	
	White Female	-3.487*	-9.048*	2.084*
	Black Female	-3.480*		
Conceptual	White Male	4.311*	8.218*	
	White Female	1.782	5.604*	-2.652*
	Black Female	-0.605		
Neutral Preference	White Male	2.534*	3.303*	
	White Female	0.799	1.485	-1.839
	Black Female	2.970*		
Applied	White Male	-5.357*	-8.627*	
	White Female	-1.586	-4.763*	4.161*
	Black Female	-3.378*		
Independent/Conceptual	White Male	1.582	5.360*	
	White Female	1.442	5.144*	-0.127
	Black Female	-1.623		
Independent	White Male	2.347*	4.219*	
	White Female	2.019*	3.846*	-0.318
	Black Female	-0.330		
Independent/Applied	White Male	-7.593*	-7.759*	
	White Female	-2.385*	-2.165*	5.914*

* $p < .05$

Discussion

Students in the postsecondary setting and students in the secondary setting have gender and race differences. Additionally, there are interaction effects of race and gender, indicating the complexity of understanding learning style.

When gender alone was under consideration, several trends emerged. Four typologies on the postsecondary level had higher proportions of males or females. The social and social/applied typologies had higher proportions of males than females, and the conceptual and independent/conceptual styles had higher proportions of females than males. On the secondary level, gender differences were significant in all typologies with the exception of two: social and independent. Females had higher proportions than males in social/conceptual and conceptual typologies, and males had higher proportions than females in social/applied, neutral, applied, independent/conceptual, and independent/applied typologies. Trends noted about the two populations were: (1) young men who choose to go to college have more social styles than the general population of young men in high school; (2) young men in high school follow applied and independent styles more so than young women; and (3) females in both the postsecondary setting and secondary setting follow conceptual styles of learning on the applied to conceptual continuum.

Race differences were pronounced in both settings. On the postsecondary level, six learner typologies were significantly different, and on the secondary level, eight learner typologies were significantly different. On the six areas for the postsecondary setting, the same pattern existed for the secondary setting. The pattern was that Blacks, when compared to Whites, had higher proportions of students in the social/conceptual, conceptual, and independent/conceptual styles, and Whites had higher proportions of students in social/applied, applied, and independent/applied styles. In the other two categories that were significant in the

secondary setting, Blacks were in the categories of neutral preference and independent with higher proportion than Whites were.

The patterns vary when males and females within the races are under consideration. The differences are pronounced enough to be significant at both the postsecondary setting and the secondary setting. Black postsecondary males followed patterns that were similar to, but more pronounced than, those of White postsecondary females. Black males on the postsecondary level were high on the social end of the social to independent continuum and high on the conceptual end of the applied to conceptual continuum. White male postsecondary students preferred the social and applied ends of the two continua. White females had the most nearly even distribution in the learner typologies of all groups but favored social and conceptual styles. Black postsecondary females were high on the conceptual end of the applied to conceptual continuum but favored independent styles over social styles. On the secondary level, Black males continued to favor the social and conceptual styles but their distributions were less pronounced. White male secondary students were less social and much more applied than their postsecondary counterparts. White secondary females were high on the social end of the social to independent continuum and high on the applied end of the applied to conceptual continuum, a change from the postsecondary group. Black females on the secondary level followed one trend established on the postsecondary level, that is, they continued to follow conceptual styles. However, the secondary population had more Black female learners in the social category than did the postsecondary sample.

The information in this study is very important to administrators, counselors, teachers, and other people interested in accommodating instruction, curriculum, and services to the learning styles of students. The findings show that students have representation in all the categories; therefore, any attempt to teach or provide

services to one group over another would be a mistake. The findings show also that Blacks tend to be more conceptual than applied, but Black males appear to be more social than Black females. White males are very pronounced on the applied end of the applied to conceptual continuum on the secondary level but less pronounced in the postsecondary setting. White females in the postsecondary setting continue as they did in high school to follow conceptual styles but are less social-oriented in higher education. These findings suggest that institutions may teach self-awareness of style and try to develop alternate teaching styles as well as learning styles for students to function. The more nearly successful person uses one primary style and one or more ready auxiliary styles in school and everyday life.

PART III

CONCLUSION

CHAPTER 8

SUMMARY, IMPLICATIONS, AND LIMITATIONS

Introduction

The research was a series of studies related to learning styles of postsecondary and secondary students. Phase I of the research examined the learning styles of first-year students in colleges and universities. Phase II investigated the learning styles of students with various majors in colleges and universities. Along with the study of majors, the research examined the association of specific social variables and learning style. Phase III investigated the retention of college and university students with various learner typologies. Phase IV involved an extensive study of the learning styles of high school students. The final phase, Phase V, examined learning style in relation to gender and race.

Phase I

Among the findings for learning style characteristics in Phase I were the following:

1. First-year college and university students preferred a personal relationship with the instructor, clearly organized course work, and specific assignments and requirements over other conditions of learning, such as studying alone, being highly competitive with peers, or relying on authority.

2. The area of interest chosen as first place was working with people, with working with inanimate objects as the second choice, and numerics and qualitative materials as third and fourth. The two preferred modes of learning were direct experience and visuals, rather than listening and reading.

3. Gender differences existed on learning with peers, organization, detail, independence, numeric, qualitative, inanimate, people, and listening. Males relied more on peers, working independently, use of numbers, and manipulation of concrete

objects than did females. Females liked organization, detail, language activities, other people, and listening more than males did.

4. Race differences occurred on instructor, authority, people, listening, reading, iconics, and direct experience. Blacks preferred authority and getting information from reading more than Whites did, while Whites felt a need to know and relate to the instructor, to work with other people, and to learn by listening, iconics, and direct experience more than Blacks did.

Components of the learning style characteristics generated nine learner typologies: social, independent, applied, conceptual, social/applied, social/conceptual, independent/applied, independent/conceptual, and neutral preference. An examination of the data overall indicated high categories for students were social (14.2%) and social/conceptual (13.5%), and low categories were independent/applied (7.2%), independent (8.3%), and applied (9.5%). The patterns varied when controlling for gender and race. For males, high categories were social (16.6%), social/applied (16.2%), and social/conceptual (13.9%), but for females, high categories were conceptual (14.0%), social/conceptual (13.2%), and independent/conceptual (12.6%). High categories for Whites were social (15.4%), social/applied (14.6%), and applied (12.2%). High categories for Blacks were social/conceptual (15.4%), conceptual (14.4%), and neutral preference (14.4%). The chi-square statistical test showed that gender and race differences were significant in the postsecondary sample of first-year students.

Learning style had an association with achievement of first-year students as measured by grade point average and scores on the *Scholastic Aptitude Test*. Students with the social/applied, independent/applied and social styles had higher grades than did students with the other styles. Students with neutral preference had the lowest grade point averages when compared with students in other categories. Grade point averages in six categories (social/applied, independent/applied, social,

applied, social/conceptual, and conceptual) differed significantly from the averages in the low category (neutral preference). On the *Scholastic Aptitude Test*, there was an effect of learning style on the mathematics subtest, but not on the verbal subtest. Students with social, social/applied, independent, and applied styles outperformed students in other styles in mathematics. When mathematics and verbal subtest scores were combined for total test scores, the differences in scores for learner typologies were statistically significant, also. Overall, the social and applied styles proved to be styles that responded well to standardized testing.

Phase II

Major or discipline in colleges and universities had a relationship to learning style. On the applied to conceptual continuum, high numbers of persons selecting the applied or combination applied styles were in the disciplines of mathematics, science, or education. High numbers of persons with conceptual or combination conceptual styles were in the disciplines of humanities, business, or social science. On the social to independent continuum, all major areas had persons who preferred the social or combination social categories to independent or independent combination categories.

Some gender differences occurred with regard to the total sample; male preference was greater than female preference for the applied and independent categories, and female preference was greater than male preference for the conceptual and social categories. Within the majors, gender differences existed only in business on the applied to conceptual continuum, with males more applied than females and females more conceptual than males. On the independent to social continuum, gender differences existed for the majors of education, mathematics, business, and social science, with males more independent than females and females more social than males.

Race differences occurred with regard to the total sample. Upon examination of the two extremes, Blacks were more conceptual than Whites, whereas Whites were

more applied than Blacks. No race differences existed on the independent to social continuum. Within majors, race differences occurred in mathematics, science, business, and social science on the applied to conceptual continuum with Whites more applied than Blacks and Blacks more conceptual than Whites. Only the major of business differed for race on the independent to social continuum, with more Blacks being in the social category than Whites and more Whites being in the independent category than Blacks.

Family variables also showed an association with learning style. Father's educational level, but not mother's educational level, was significantly related to style. Students with fathers without college or university degrees followed a pattern of learning style that was more conceptual than applied, whereas students with fathers with college or university degrees followed styles that were more applied than conceptual. On the social to independent continuum, both groups favored social styles, but the students who had fathers with college or university degrees had more independent styles than did the other group. Family size had a significant effect on learning style with large families having more conceptual learners and small and medium-sized families having more applied learners. The small family produced more social learners, and the medium and large families produced more independent learners. Community size (rural, suburban, and urban) had no effect on learning style. However, there was an association of size of college or university to learning style; the two moderate-sized universities and two small colleges had more social/conceptual and conceptual learners than the large university had. The schools varied little on the social to independent continuum regarding students in the various categories. In the applied and combination applied categories, the large university exceeded all other colleges or universities in the percentage of students in these typologies.

Phase III

Learning style had an association with retention rates only when studied by gender within the races. Retention rates were higher, however, in specific typologies when compared to other typologies. For example, the applied and independent categories had higher percentages of students to stay in school than other styles. The social/conceptual typology had the lowest retention rate; this category was so low that it was statistically different from the other categories. An examination of gender showed that males stayed in school at higher rates than did females, regardless of style. However, high styles for retention for males were independent/conceptual and social, and the high style for retention for females was applied.

Whites stayed in school at higher rates than did Blacks in each learner typology. Styles with high holding power for Whites were independent/applied and independent/conceptual; whereas for Blacks, the styles were social/applied, applied, neutral preference, and independent. When controlling for race and gender, one finds that the social/applied learner typology had the lowest holding power for Black females, and the independent and independent/applied typologies had the least holding power for Black males. White females using the independent style showed higher retention rates when compared to counterparts following different learning styles.

Phase IV

The purpose of Phase IV was to investigate the learning styles of secondary students. The study examined learning style characteristics as well as learner typologies. On condition of learning, secondary students preferred instructor-assisted instruction, clear organization, and learning with peers. In area of interest, secondary students preferred working with inanimate materials or objects first and people second. Their favorite mode of learning was visual and direct experience.

Gender and race differences occurred on the condition of learning. With the exception of instructor, significant differences exist between males and females on all

characteristics. Males had higher preferences for goal setting and competition, but females had higher preferences for peer, organization, detail, independence, and authority. Blacks and Whites differed on peer, competition, instructor, detail, independence, and authority. While Blacks had higher preference for competition, detail, and authority, Whites were higher on their choices for independence, learning with peers, and interaction with the instructor.

Secondary students had significant gender and race differences on area of interest. Males preferred mathematics and inanimate objects while females preferred language-oriented activities and people. When compared with the other race, Blacks had a high preference for the categories of numerics and qualitative experiences, and Whites had high preferences for working with inanimate objects and people.

There were also gender and race differences with regard to mode of learning. Gender differences occurred in reading and iconics with females selecting reading more often than did males, and males selecting iconics more often than did females. Race differences occurred in reading, iconics, and direct experience. While Blacks preferred the reading mode, Whites preferred direct experience and iconics.

Learning style characteristics showed specific interaction effects for gender by race. Interactions occurred for peer (high preference for White females and Black males), goal setting (high preference for Black males and low preference for White females), instructor (high preference for White females), detail (high preference for Black females), independence (high preference for White males), and authority (high preference for Black males and White females). In area of interest, inanimate (high preference for White males) and people (high preference for White females) had an interaction effect for race and gender.

Learner typologies, computed from the learning style characteristics, varied from 16.9 percent of the secondary students in the social category to 7.0 percent of the students in the independent/conceptual category. Other high categories were

social/applied (14.3%), neutral preference (12.0%), social/conceptual (11.3%), and applied (10.5%). In addition to independent/conceptual, other low categories were independent (9.6%), conceptual (9.1%), and independent/applied (8.9%).

The research examined the association of learner typology with socioeconomic status and grade level. There was a significant relationship of style with socioeconomic status. Students who received free or partially free lunch were more conceptual than applied on the applied to conceptual continuum. Higher socioeconomic counterparts were more applied than conceptual. Both groups had similar patterns on the social to independent continuum with both high and low status students having more social than independent styles. In regard to grade level, no maturational patterns were in evidence. Although the number of students in the categories decreased in the upper grades, the rank order of styles remained approximately the same, an indication of a continuous pattern from beginning to ending in high school.

Another area of exploration was the close examination of the association of learner typology with perceived academic achievement. A statistically significant association occurred between the students' self rating of achievement and learning style. Students with the social, social/applied, social/conceptual, and conceptual typologies rated themselves higher on achievement than did students with applied and independent typologies.

A comparison of secondary students with students from colleges and universities found commonalities in regard to learner typology. Only two styles differed significantly. The conceptual typology and the independent/conceptual typology have a higher percentage of postsecondary students than secondary students. When the three categories on the two continua are under examination, no significant differences occur on the social to independent continuum; however, differences on all three categories of the applied to conceptual continuum were significant. Postsecondary

students were more conceptual than secondary students, and secondary students were more applied than postsecondary students. Also, a higher percentage of secondary students than postsecondary students was in the neutral category, a category that indicates no definite allegiance to any of the styles.

Phase V

The last phase examined learning style of the total sample of students at the postsecondary level and the total sample of students at the secondary level with regard to gender and race. Significant differences existed in learning style between males and females and Blacks and Whites at both levels.

In the postsecondary sample, styles that were different for males and females were social, social/applied, conceptual, and independent/conceptual with males having more social and social/applied styles and females having more conceptual and independent/conceptual typologies. In high school, all typologies differed significantly with the exception of social and independent, with females having more social/conceptual and conceptual styles and males having more social/applied, neutral preference, applied, independent/conceptual, and independent/applied styles.

The pattern in style varied for the two settings for race. Black postsecondary students had more social/conceptual, conceptual, and independent/conceptual styles than White counterparts had. White postsecondary students had more social/applied, applied, and independent/applied styles than Black counterparts had. When compared to White secondary students, Black secondary students had more social/conceptual, conceptual, and independent styles as with the postsecondary students, but they also had more neutral preference and independent styles. Like the postsecondary group, Whites in high school had more students in the applied styles (social/applied, applied, and independent/applied) when compared with their Black counterparts. Therefore, the social style was the only style with no significant difference between races on the

secondary level, and social, neutral preference, and independent were the only styles with no differences on the postsecondary level.

Controlling for gender and race showed interaction effects at both the postsecondary level and the secondary level. At the postsecondary level, Black males differed from White males, White females, and Black females on social/conceptual and independent styles with a high percentage of learners in the social/conceptual styles and a low percentage of learners in the independent style. Black males differed from Black females on social and independent/conceptual, Black females and White males on social/applied and conceptual, and White males and females on applied and independent/applied. Black females differed from White males and White females in five areas: social/conceptual, social/applied, conceptual, applied, and independent/conceptual. Also, Black females differed from White males on social and White females on independent/applied. The statistical profile that resulted from this investigation was that Black postsecondary females have conceptual and independent styles of learning, but White postsecondary females have social and conceptual styles. The profile for White males in colleges and universities indicated that they have social and applied styles, whereas Black males have very pronounced social or conceptual styles.

On the secondary level, the percentage of Black males in the learner typologies differed significantly from the percentage of White males; in fact, the only category that was similar was that of the independent/conceptual style. Black males differed in their choice of styles from Black females in five learner typologies: social, social/applied, conceptual, applied, and independent/conceptual. White females' choices of style were more like those of the Black male than other groups; White females were similar to Black males on six styles: social/conceptual, social, conceptual, neutral preference, applied, and independent/conceptual. Black females were similar in style to White males on social and White females on neutral preference

but dissimilar in proportion in all other categories. White males were similar to White females in four categories: social/conceptual, neutral preference, independent/conceptual, and independent. One can see distinct patterns for each subgroup.

Implications

This research provides both information and implications in regard to learning styles about a large sample of students from the postsecondary setting and the secondary setting. The sample was evenly divided according to Whites and Blacks on the postsecondary level, while there were roughly six hundred more White students on the secondary level. The samples, however, provided an avenue to study race differences as well as gender and race interactions. The findings from the series of studies that occurred over the six-year period have professionally delineated implications for both settings in regard to educational practices.

The findings from this research provide some information for suggesting change in various aspects of postsecondary and secondary life. Because the model was affective, style differences represent levels of motivation, judgements, values, and emotions that move students to respond in particular learning environments.

The first implication is that it is urgent that institutions recognize, accept, and understand diversity in regard to learner typologies. Throughout the studies, gender and race differences occurred. In addition to gender and race differences, there were interaction effects of gender by race. Acceptance of style as a fundamental strength of each person contributes to the development of self-esteem, and ultimately, to academic achievement (Ault, 1986; Barger & Hoover, 1984). When students have feelings of accomplishment and satisfaction, attitudes are more nearly positive, achievement is higher, and dropout rates are lower; the alternative is demonstrably less desirable (Charkins, O'Toole, & Wetzel, 1985).

The second implication is that teachers and counselors teach students about their learning styles, and to do so helps students understand independently their own strengths and weaknesses. Comparison with other learning style categories showed that persons in the research with no dominant learner typology or style (neutral preference) had poorer grades than other students. Students in high school with styles devalued by traditional education rated themselves lower in achievement. For example, students with the independent and independent/applied styles rated themselves as poor achievement performers, whereas social and conceptual learners rated themselves high on achievement. Derry and Murphy (1986) indicated that one major educational objective is to teach students how to learn and how to manage and monitor their selection and use of various learning styles and strategies. Therefore, faculty and counselors have the responsibility to help students develop primary and secondary styles of learning, as well as to adjust instructional delivery and assignments to the differing strengths of students. As students adjust to new situations and environments and maturate beyond the learning style restrictions of their first year on the secondary and postsecondary level, the development of a repertoire of learning styles becomes important to the student expecting to obtain a diploma from high school and a degree from a college or university.

The third implication is that it is emphatically necessary that teachers fluently use a variety of teaching techniques, especially cooperative learning strategies. The traditional lecture and independent project fit the learning style of only a few learners. The research showed a high percentage of young men, both White and Black, who are social learners. It has been assumed generally that young women typically put emphasis on close relationships, but to find that relatively substantial numbers of young men like to learn with peers is a unique discovery.

The fourth implication is that administrators hire faculty and other support staff with diverse learning styles because such styles guide teaching, counseling, and

communication practices. Many instructors are introverts and think abstractly or intuitively (Hanson, Silver, & Strong, 1984). If this occurs, there is little potential for a match of teacher and learner on teaching and learning style. To serve students better, therefore, institutions can provide a choice of instructors and other personnel who work with students so that students can ideally select persons who more nearly match their own styles. Advisors or counselors are able to assist in the selection process, a process students find pertinent to academic success in colleges or universities, as well as high schools.

The final implication is the need for further research on learning styles by faculty in colleges and universities and in high schools. The influences and techniques for matching the styles of teachers and students for instruction to determine the results were beyond the scope of this research. Because high schools are now adopting an applied curriculum that is more nearly appropriate to students with applied styles of learning, researchers are obliged to examine the effect of this curriculum on actual grades and self-ratings. This research studied specific social variables, but more research on socioeconomic levels and family variables would be of value. Information on styles, when linked with other data on students, holds great promise for helping faculty improve their teaching and for assisting other support personnel to improve their communication techniques for holistic development of students and the retention of them.

Limitations

Although limited to one Southern state with a large rural population, this research showed the diversity of students at colleges and universities as well as high schools in regard to style. Moreover, the research determined that style patterns exist with regard to gender and race. The findings are to be considered tentative because of limitations in scope. The study used cluster sampling and, therefore, may not be

representative of the total population. Although the selection of institutions was nonrandom, unique characteristics of the institutions and the relative location in the state were of particular but not necessarily restricted interest. Nonetheless, the research provides necessary information on learner typologies or learning styles that is presently missing from the literature.

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Appendix A

A-1

STUDENT DEMOGRAPHIC QUESTIONNAIRE

DIRECTIONS: The principal investigator needs certain information about you to study associations with learning styles. Please use a check mark (✓) or fill in the blank with the information as requested.

1. SOCIAL SECURITY NUMBER:_____

2. COLLEGE OR UNIVERSITY:

_____South Carolina State University
_____Francis Marion University
_____Clemson University
_____Claflin College
_____Newberry College
_____Other

3. CLASS:

_____Freshman (0-29 hours)
_____Sophomore (30-59 hours)
_____Junior (60-94 hours)
_____Senior (95-160+ hours)

4. MAJOR OR AREA OF STUDY:

Mathematics:

_____General Mathematics
_____Engineering
_____Computer Science
_____Statistics
_____Other _____
specify

Home Economics:

_____General Home Economics
_____Food and Nutrition
_____Clothing and Design
_____Individual and Family Development
_____Other_____
specify

Science:

_____Biology
_____Chemistry
_____Physics
_____Geology
_____Anthropology
_____Astronomy
_____Nursing
_____Pharmacy
_____Premedicine
_____Other_____
specify

Business:

_____Economics
_____Agribusiness
_____Management
_____Banking and Finance
_____Marketing
_____Accounting
_____Secretarial Science
_____Office Occupations
_____Other_____
specify

Humanities:

_____Art
_____Music
_____English
_____Foreign Language
_____History
_____Drama
_____Other_____
specify

Agriculture:

_____Horticulture
_____Agronomy
_____Entomology
_____Soil Conservation
_____Forestry
_____Landscaping
_____Other_____
specify

Social Science:

_____Education (Child Development, Elementary, Secondary)
_____Physical Education
_____Psychology
_____Sociology
_____Social Welfare
_____Political Science
_____Criminal Justice
_____Law Enforcement
_____Speech Pathology
_____Counseling
_____Other_____ (specify)

5. AGE:

_____16-18
_____19-21
_____22-24
_____25-27
_____28-30
_____Over 31

6. SEX

_____Male
_____Female

7. RACE:

_____White
_____Black
_____Other

8. SCHOLASTIC APTITUDE TEST (SAT) SCORE:

Verbal

_____700-800
_____600-699
_____500-599
_____400-499
_____Below 400

Mathematics

_____700-800
_____600-699
_____500-599
_____400-499
_____Below 400

Total

_____1400-1600
_____1200-1399
_____1000-1199
_____800-999
_____600-799
_____Below 600

9. EDUCATION LEVEL OF MOTHER

_____Below 6th Grade
_____Some High School
_____High School Graduate
_____Some College Training
_____Associate Degree
_____College Degree
_____Graduate Degree

10. EDUCATION LEVEL OF FATHER

_____Below 6th Grade
_____Some High School
_____High School Graduate
_____Some College Training
_____Associate Degree
_____College Degree
_____Graduate Degree

11. COLLEGE GPA:

_____Above 3.5
_____3.0 - 3.4
_____2.5 - 2.9
_____2.0 - 2.4
_____Below 2.0

12. COLLEGE CREDIT HOURS COMPLETED

_____Below 30 hours
_____30-60 hours
_____61-90 hours
_____Above 90 hours

13. HOME TOWN DESCRIPTION

Location:

_____In-State
_____Out-of-State

Type by Population:

_____Rural (10,000 or less)
_____Suburban (10,000 - 20,000)
_____Urban (Over 20,000)

14. FAMILY CONSTELLATION:

Number of Siblings:

_____0
_____1
_____2
_____3
_____4
_____More than 4

A-2

STUDENT DEMOGRAPHIC QUESTIONNAIRE

DIRECTIONS: The principal investigator needs certain information about you to study associations with learning styles. Please use a check mark (✓) or fill in the blank with the information as requested.

1. SOCIAL SECURITY or STUDENT ID NUMBER:_____

2. NAME OF HIGH SCHOOL:_____

   NAME OF TOWN WHERE SCHOOL IS LOCATED:_____

3. GRADE: 9th_____ 10th_____ 11th_____ 12th_____

4. AGE:_____ 5. SEX: 6. RACE:

   _____Male _____Black

   _____Female _____White

   _____Other_____

7. LUNCH STATUS:

   1._____Buy lunch at school
   2._____Bring lunch from home
   3._____Receive partial free lunch
   4._____Receive free lunch

8. EDUCATION LEVEL OF MOTHER

   _____Below 6th Grade
   _____Some High School
   _____High School Graduate
   _____Some College Training

9. EDUCATION LEVEL OF FATHER

   _____Below 6th Grade
   _____Some High School
   _____High School Graduate
   _____Some College Training

_____Associate Degree
_____College Degree
_____Graduate Degree

_____Associate Degree
_____College Degree
_____Graduate Degree

10. FAMILY CONSTELLATION:

Number of Siblings:

_____0
_____1
_____2
_____3
_____4
_____More than 4

11. What kind of Student do you consider yourself?

_____Excellent (Make mostly A's)
_____Good (Make some A's and some B's)
_____Average (Make some B's, but mostly C's)
_____Fair (Make C's and D's)
_____Poor (Make D's and F's)

Appendix B

Appendix B-1

Means and Standard Deviations for Learner Characteristics by Gender

Characteristic	Males[1]		Females[2]	
	Mean	Standard Deviation	Mean	Standard Deviation
Condition of Learning				
Peer	14.66	3.19	15.34	2.91
Organization	12.59	3.00	11.50	3.04
Goal Setting	15.77	3.11	16.06	3.13
Competition	16.98	2.95	17.10	2.57
Instructor	11.60	3.26	11.99	3.27
Detail	13.20	3.06	12.70	3.16
Independence	18.65	3.43	19.16	3.31
Authority	16.55	3.18	16.16	3.32
Area of Interest				
Numeric	16.61	4.12	15.93	4.87
Qualitative	17.32	3.92	14.96	4.46
Inanimate	13.36	3.93	16.81	3.93
People	14.69	3.71	12.29	3.79
Mode of Learning				
Listening	15.07	3.78	14.56	4.11
Reading	18.10	4.24	18.21	4.26
Iconic	13.76	4.03	13.74	4.10
Direct Experience	13.08	3.88	13.48	4.12

Note: Scores are Ranks. Lower scores signify higher preference.

[1] Sample had 475 males.

[2] Sample had 493 females.

Appendix B-2

Means and Standard Deviations for Learner Characteristics by Race

Characteristic	Whites[1]		Blacks[2]	
	Mean	Standard Deviation	Mean	Standard Deviation
Condition of Learning				
Peer	14.94	3.03	15.08	3.13
Organization	11.95	3.10	12.19	3.03
Goal Setting	15.99	3.25	15.85	2.86
Competition	17.12	2.78	16.88	2.73
Instructor	11.35	3.27	12.37	3.20
Detail	13.03	3.34	12.86	2.80
Independence	18.78	3.46	19.11	3.25
Authority	16.86	3.30	15.66	3.09
Area of Interest				
Numeric	15.48	4.73	15.08	4.32
Qualitative	16.37	4.48	15.81	4.22
Inanimate	14.94	4.58	15.31	3.86
People	13.19	4.14	13.79	3.64
Mode of Learning				
Listening	14.50	3.97	15.21	3.92
Reading	19.29	3.99	16.71	4.13
Iconic	13.37	4.09	14.22	3.95
Direct Experience	12.84	4.03	13.85	3.92

Note: Scores are ranks. Lower scores signify higher preferences.

[1] Sample had 540 Whites.

[2] Sample had 416 Blacks.

Appendix B-3

Means and Standard Deviations for Learner Characteristics of Gender by Race

	Males				Females			
	Whites		Blacks		Whites		Blacks	
Characteristic	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Condition of Learning								
Peer	14.83	3.27	14.39	3.07	15.05	2.77	15.69	3.06
Organization	12.42	3.09	12.84	2.89	11.45	3.03	11.61	3.04
Goal Setting	15.71	3.22	15.96	2.85	16.29	3.26	15.74	2.87
Competition	17.04	3.01	16.80	2.85	17.21	2.52	16.96	2.23
Instructor	11.27	3.42	12.05	3.00	11.43	3.13	12.65	3.34
Detail	13.19	3.33	13.24	2.67	12.86	3.36	12.53	2.88
Independence	18.51	3.42	18.93	3.42	19.05	3.48	19.26	3.09
Authority	17.03	3.19	15.79	3.05	16.67	3.40	15.56	3.13
Area of Interest								
Numeric	14.76	4.27	14.40	3.89	16.22	5.07	15.68	4.59
Qualitative	17.53	3.96	17.11	3.86	15.16	4.67	14.69	4.21
Inanimate	13.05	4.11	13.75	3.63	16.92	4.20	16.66	3.54
People	14.63	3.88	14.75	3.43	11.69	3.86	12.97	3.61
Mode of Learning								
Listening	14.80	3.89	15.49	3.60	14.18	4.02	14.97	4.18
Reading	19.14	3.95	16.68	4.27	19.44	4.04	16.74	4.02
Iconic	13.57	4.03	13.85	4.03	13.17	4.14	14.46	3.88
Direct Experience	12.48	3.74	13.88	3.94	13.21	4.29	13.83	3.92

Appendix B-4

Means and Standard Deviations of Grade Point Average for Learner Typology by Gender and by Race

	Gender				Race			
	Males		Females		Whites		Blacks	
Learner Typology	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Social/Conceptual	2.39	.73	2.50	.86	2.59	.83	2.28	.73
Social	2.44	.83	2.69	.78	2.63	.82	2.43	.79
Social/Applied	2.58	.77	2.56	.91	2.63	.81	2.50	.73
Conceptual	2.30	1.07	2.54	.92	2.53	1.06	2.38	.91
Neutral Preference	2.06	.74	2.39	.75	2.30	.85	2.12	.65
Applied	2.52	.84	2.55	.75	2.55	.84	2.49	.66
Independent/Conceptual	2.33	.86	2.51	.82	2.57	1.04	2.34	.73
Independent	1.91	1.00	2.59	.74	2.43	1.01	2.20	.81
Independent/Applied	2.46	.77	2.64	.65	2.67	.68	2.41	.73

Appendix B-5

Means and Standard Deviations of *Scholastic Aptitude Test* Scores (Total) for Learner Typology by Gender and by Race

	Gender				Race			
	Males		Females		Whites		Blacks	
Learner Typology	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Social/Conceptual	751.06	290.07	741.08	332.68	887.30	288.45	592.66	263.39
Social	852.53	258.41	858.97	197.85	972.29	176.99	675.37	193.69
Social/Applied	860.91	233.40	880.26	226.76	962.15	169.70	656.00	211.65
Conceptual	773.40	301.71	762.75	320.26	955.27	236.98	596.83	293.91
Neutral Preference	788.46	254.65	770.66	257.98	906.62	221.42	637.33	212.19
Applied	937.27	205.07	859.35	223.40	964.85	162.94	712.08	241.43
Independent/Conceptual	807.00	325.90	762.42	268.20	978.86	211.95	616.96	243.97
Independent	806.25	327.03	741.22	248.84	915.75	221.76	601.03	249.08
Independent/Applied	924.40	204.06	883.33	205.48	1007.56	138.99	684.58	125.84

Appendix B-6

Means and Standard Deviations of *Scholastic Aptitude Test* Scores (Mathematics) for Learner Typology by Gender and by Race

	Gender				Race			
	Males		Females		Whites		Blacks	
Learner Typology	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Social/Conceptual	390.15	153.66	384.77	175.21	458.25	154.30	307.81	137.13
Social	456.20	146.11	462.41	114.28	525.06	102.53	357.04	108.60
Social/Applied	478.44	132.21	475.00	127.04	527.72	100.40	365.14	120.69
Conceptual	412.98	167.38	394.64	161.75	496.73	123.81	316.33	149.11
Neutral Preference	425.69	143.68	402.13	139.37	475.85	131.12	343.67	116.63
Applied	527.05	131.41	468.04	131.60	536.82	105.16	387.08	145.47
Independent/Conceptual	429.75	171.34	397.26	138.86	511.59	118.89	327.68	125.87
Independent	433.44	178.25	394.90	131.25	482.00	121.39	327.18	138.22
Independent/Applied	502.40	115.41	476.89	109.96	542.67	80.07	375.00	74.25

Appendix B-7

Means and Standard Deviations of *Scholastic Aptitude Test* Scores (Verbal) for Learner Typology by Gender and by Race

	Gender				Race			
	Males		Females		Whites		Blacks	
Learner Typology	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Social/Conceptual	360.91	145.00	356.31	162.79	429.05	142.98	284.84	133.46
Social	396.33	125.80	396.55	96.35	447.23	91.99	318.33	99.64
Social/Applied	382.60	111.75	405.26	107.32	434.56	83.23	290.86	100.80
Conceptual	360.43	143.36	368.41	165.74	458.91	126.90	280.50	131.05
Neutral Preference	362.77	120.19	368.52	128.02	430.77	104.72	293.67	102.10
Applied	410.23	86.84	389.13	105.15	426.52	76.53	325.00	108.31
Independent/Conceptual	377.25	160.21	363.55	136.87	467.27	105.97	287.50	122.64
Independent	372.81	156.64	346.33	126.86	433.75	112.40	273.85	118.56
Independent/Applied	422.00	99.96	408.67	106.10	467.11	71.75	309.58	71.35